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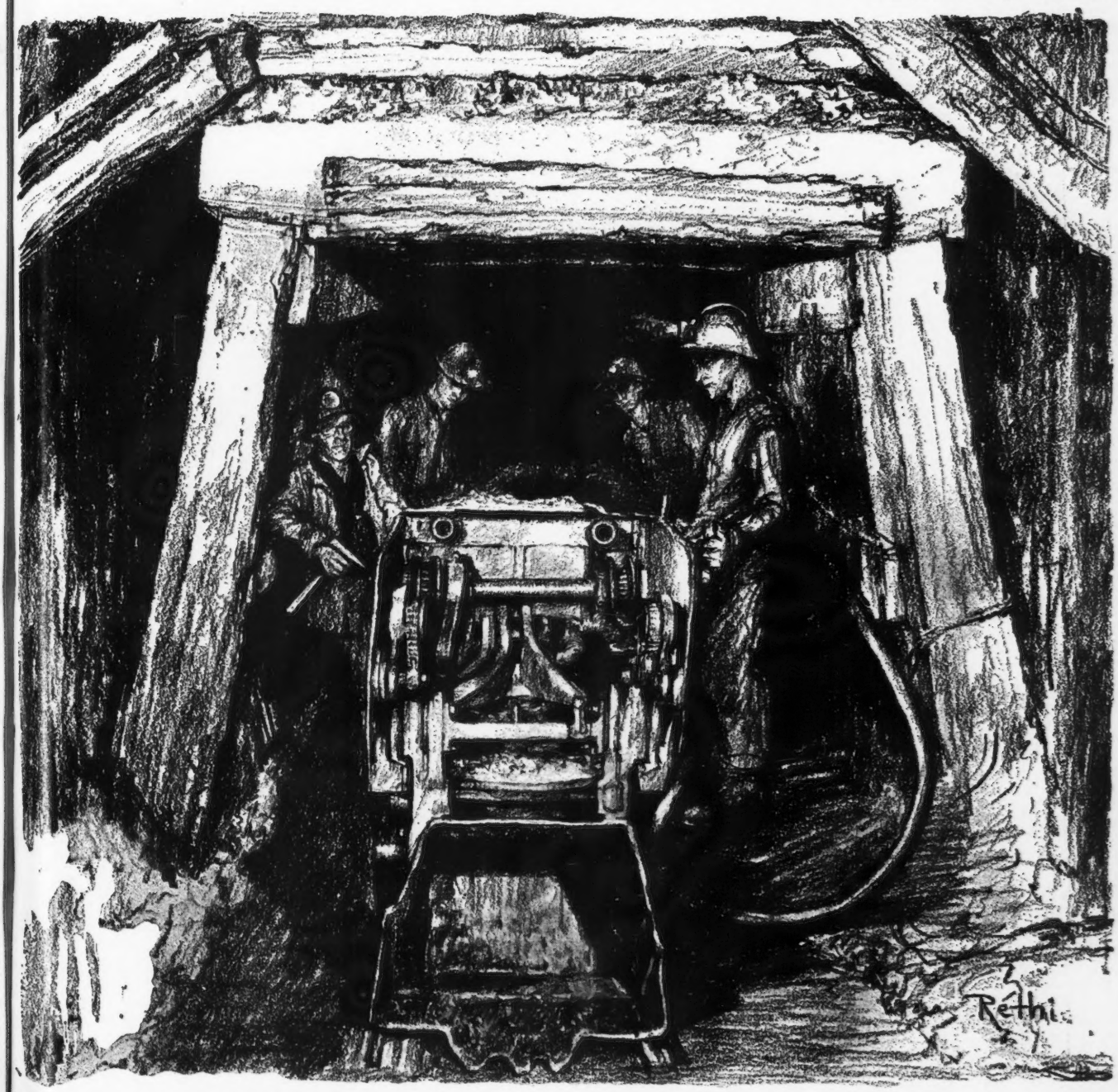

Moving Loading Machine Back After Cleaning Up the Face at Western Mine

Stoping With Diamond Drills

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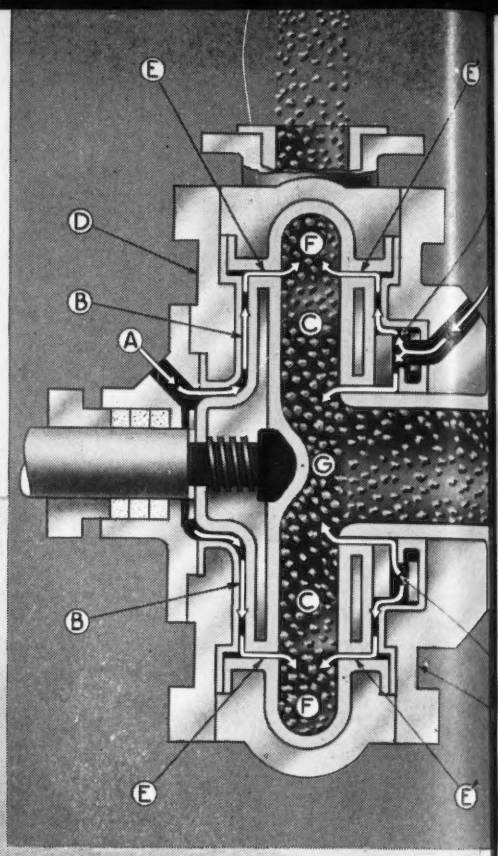
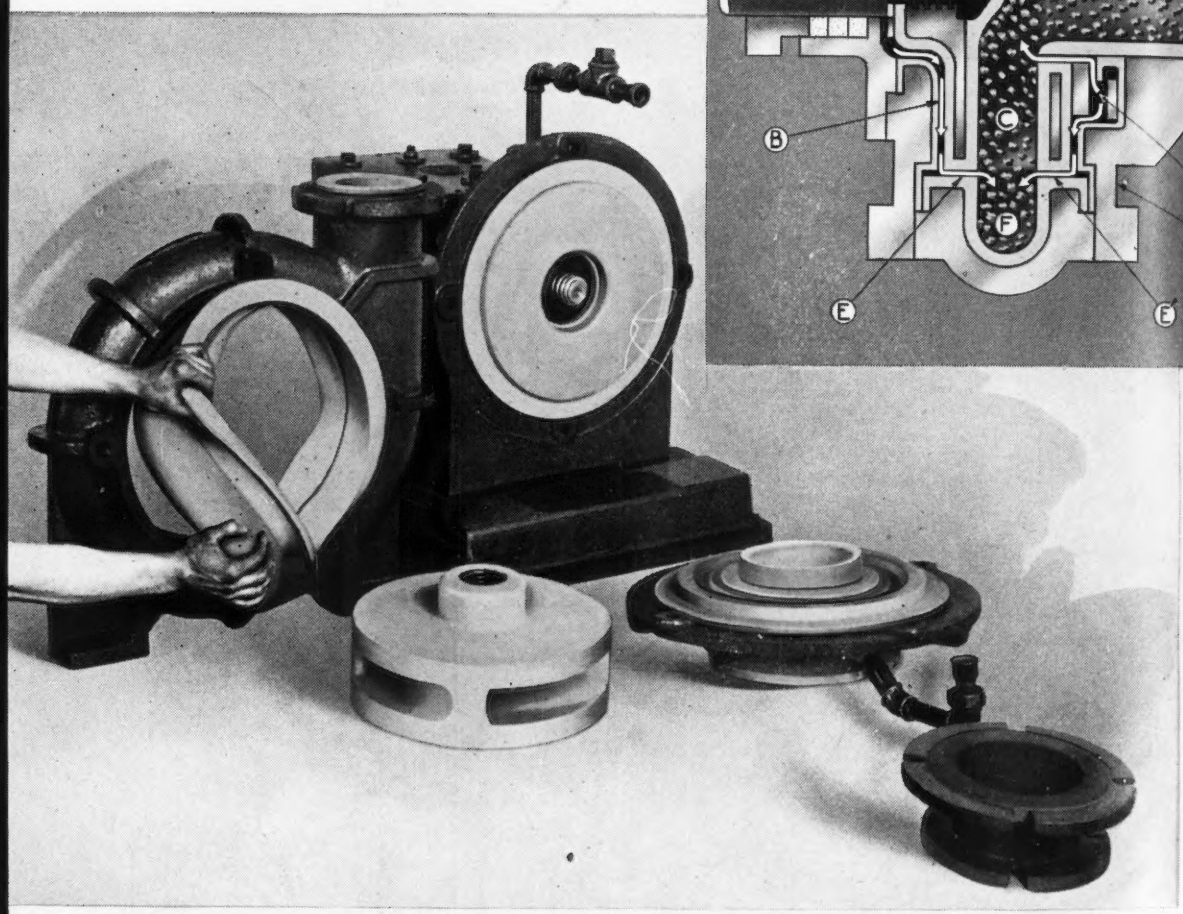
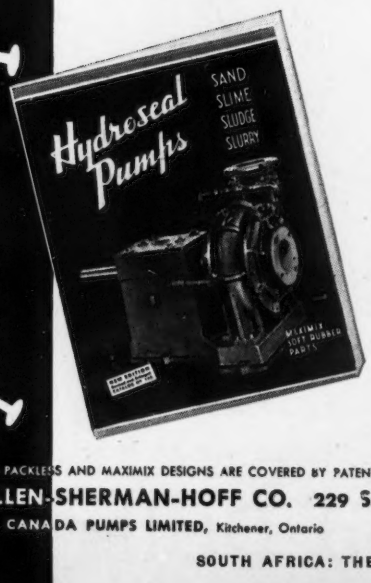
Down to Brass Tacks *about why You Should Buy* HYDROSEALS





Maximix Replaceable Parts Outlast Metal



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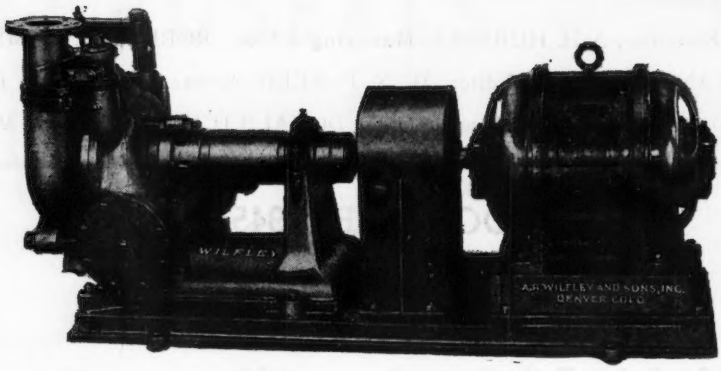

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LABOR *and* MANAGEMENT MEET— *for* PEACE *or* CIVIL WAR?

THE prospect of a knock-down and drag-out fight in the automobile industry does not augur well for the reconversion outlook, which upon every other score is bright. Any widespread outbreak of the type of industrial warfare which now threatens will disrupt, more thoroughly than anything else on the horizon, an orderly transition to a peacetime economy.

It is doubly unfortunate that there should be a general tightening of union and company battle lines upon the eve of the Labor-Management Conference, which on November 5th will convene at President Truman's direction for the purpose of "working out by agreement means to minimize labor disputes." If the current work stoppages occasioned by industrial conflicts should increase rather than diminish between now and November first, the Conference atmosphere hardly promises to be favorable to a dispassionate examination of basic issues.

Yet the shadow of the threatened industrial storm that hangs over the Conference only serves to emphasize the importance of reaching satisfactory agreement upon two problems with which such a Conference might deal. The first is that of determining what machinery shall be used for settling disputes upon which employers and workers have reached an impasse. The second, and more far-reaching, is that of arriving at some common understanding upon the major issues which commonly lead to irreconcilable disputes.

Settlement of Wartime Disputes by the War Labor Board

During the war the first problem was handled largely by machinery centered in the National War Labor Board. Supported by general adherence to patriotic pledges by labor leaders and employers not to resort to the use of economic force against each other during wartime, and backed up on rare occasion by use of the President's power to seize plants for war purposes when its orders were not obeyed, the Board managed, by what amounted to compulsory arbitration, to settle the nation's wartime labor disputes with relatively little economic loss.

But it can scarcely be claimed that the War Labor Board did much to resolve the issues from which disputes grow. Indeed, the fact that it was available to issue orders in cases which the Secretary of Labor certified as likely to "lead to substantial interference with the war effort", resulted in the conversion into full fledged disputes of many disagreements which would otherwise have been settled at a local level in the course of collective bargaining. Meanwhile, local collective bargaining machinery which should have been doing most of this work was neglected, and will need thorough reconditioning even to be brought back to its prewar level of effectiveness.

With V-J Day came an abrupt change in the status of the War Labor Board. One of its main props, labor's "no strike pledge", was promptly withdrawn. It could no longer rely on the President to use his power to seize plants for war purposes to force obedience to its orders. Consequently the Board agreed that it would accept new cases only if both parties to the dispute stipulated in advance that they would abide by the Board's findings, that it would clear its dockets of old cases as rapidly as possible, and that it would then go out of business, leaving to the Labor-Management Conference the question of what should take its place in the postwar period.

What Shall Take the War Labor Board's Place?

The immediate and pressing task of the Labor-Management Conference is to agree upon machinery for settling industrial disputes in the peacetime economy.

Neither management nor labor wants the continuation of compulsory arbitration to which they submitted as a necessary war measure. But it must be clear to everyone that if any substantial proportion of the disputes that inevitably arise are settled by resort to strikes and lockouts, economic anarchy will result. Not only will it be impossible to achieve the high levels of output and employment that have been set as postwar goals, but it is questionable whether our economy could survive. The only alternative to compulsory arbitration under government auspices is for management and labor to demonstrate their ability to effect a peaceable resolution of their differences without it.

The most obvious need is to set up local machinery at the grass roots where disputes originate. That is where most of them should be settled by local negotiation and, when that fails, through voluntary submission to mediation or arbitration under terms of reference to which the parties agree. Many issues, which at plant level are relatively simple in character, are blown up to formidable dimension and complexity when they are passed along

the line for decision in Washington. The centralizing process is one that frightens everyone connected with it because it focuses attention upon the possible importance of precedents established by a decision, rather than upon resolving satisfactorily the particular dispute at hand.

Unquestionably, some Federal machinery must be provided which may be called upon in cases where the size or implications of a threatened dispute clearly run beyond local jurisdiction. That will mean the thorough revamping of conciliation and mediation machinery which exists, but which has grown rusty through disuse while compulsory arbitration was the order of the day.

At least, this involves a complete overhauling of the United States Conciliation Service with a noteworthy strengthening of its personnel. There may be wisdom also in recently advanced suggestions for the creation of a board of arbitration to act in cases voluntarily submitted by the parties concerned, and for boards of inquiry to make reports upon the merits of disputes in which the public interest is concerned. But there is valid ground for questioning what appears to be the common assumption that such machinery should be located in the Department of Labor. It belongs neither there nor in the Department of Commerce. For the work which such agencies are called upon to perform, both the appearance and fact of complete impartiality are essential to effective performance. Assurance of impartiality will not be fostered by placing them in a department specifically charged by Congress with the task of advancing the interests of wage workers.

Resolving the Issues Over Which Disputes Arise

It may be, as many think, that the forthcoming Labor-Management Conference cannot effectively handle any problems beyond the procedural ones suggested above. If that is true, its agenda probably should be restricted to planning the reconstitution of collective-bargaining and dispute-settlement machinery, in view of the urgent need for putting it in working order.

But either in this Conference, or in subsequent ones, there will have to be an attempt to reach a reasonable measure of labor-management accord upon certain basic issues over which most industrial disputes originate. The best of machinery can be swamped if disputes are generated in ever-increasing number.

Most important of such issues is that of the fair determination of wages. There is clear need for reaching agreements at least upon the major factors on which such determination should rest. It seems evident that if we are ever to hope to reach the high levels set and generally accepted as postwar goals, we must harness economic incentives to promote production efficiency. That means that workers, as well as management, must be given a genuine stake in increased productivity. No universal formula is possible, but we should be able to agree upon general principles for dividing returns derived from improved performance in output between workers and investors, and consumers in the form of lowered prices.

Again, since unionism is here to stay, general acceptance by management of the principle of collective bargaining would save innumerable disputes which are concerned more with the method of negotiation than with the concession sought. Few in management still question the validity of the collective bargaining process as such, but there are many matters to be resolved of which the question of the open shop, the union shop, or the closed shop is merely a conspicuous example, upon which there is wide divergence of conviction between and within labor and management groups.

On the management side, there is sincere concern about the intent or ability of union leaders to exercise responsible control that assures compliance with contractural obligations. Wild-cat strikes are of sufficiently frequent occurrence to give substance to this distrust, and union discipline seldom has been administered in a decisive or effective fashion. The prospective rivalry of three competing labor organizations of national scope gives management little confidence that a bargain made and kept in good faith with any one of them provides assurance against work stoppages.

All of these matters, and many others, need thrashing out between management and labor, with the view of arriving at as large a measure of specific and detailed agreement as can be achieved. The greater the area of such agreement, the smaller will be the area for disputes that must be handled by settlement machinery, or put to the final test of force.

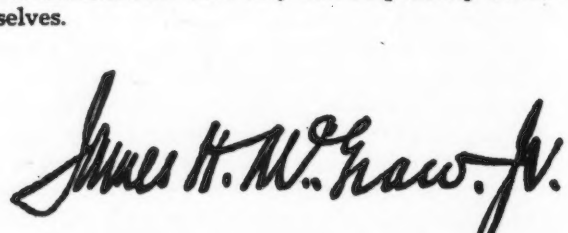
Peace or Civil War in Industry

The Labor-Management Conference is of major importance to national welfare. It is important even if it restricts its objectives to the procedural problem of how industrial disputes are to be handled.

It can make an even larger contribution if it lays the groundwork for an attempt to reach working agreements upon such policy issues as have been cited above.

Neither management nor labor can afford to lend anything less than their best intelligence and effort to an attempt to arrive at common understanding. Success will mean that we have a genuine chance of reaching new levels of economic well-being. Failure will mean industrial civil war, in which the casualties will be high. One almost certain casualty of such a war will be the principle of collective bargaining, since the Government can scarcely refrain from establishing compulsory arbitration if sufficient breakdown occurs.

It is to the vital interest of both management and labor to demonstrate that they can responsibly control themselves.



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ENGINEERING AND MINING JOURNAL

October, 1945

What Are Radioactive Minerals?

THE ADVENT of the atomic bomb made it a certainty that attempts would be made to control the resources from which uranium is extracted, as one means of preventing this terrible instrument of destruction from getting into irresponsible hands. This is a type of control that thinking people everywhere will approve. Considering the widespread occurrence of uranium, summarized in our last issue, there are grounds for believing that attempt to control the natural sources of uranium may fail to safeguard civilization's future. Nevertheless, in the light of present knowledge, there is no sensible course but to try.

However, we believe that the terms of the Presidential order withdrawing all public lands containing deposits of radioactive minerals from location ought to be modified, in view of the fact that most common rocks are slightly radioactive. Certainly there is no sense in restraining locations on something over 80 percent of our public lands, the vast bulk of which offers no likelihood of serving as a source of uranium.

The Mining Industry Can Employ Its Veterans

HIGHGRADING the voluminous literature which deals with re-employment of veterans and applying the common-sense part of it to mining, we came up with the following conclusions:

1. Mining, by and large, has plenty of jobs available for its returning veterans. It will, in fact, need more good men than its own veteran group can supply. To aid in attracting desirable men from the large number that were not jobholders before entering service, *E. & M. J.* is publishing a pamphlet describing the mining industry and its opportunities. This will be handed to interested men through the U. S. Employment Service and will also be printed in our next issue.

2. Many discussions of how to handle the returning veteran erroneously emphasize the idea that veterans are borderline mental cases, stricken with "battle fatigue" or psychoneurosis and likely to "fly off the handle" at slight provocation. The great majority of veterans are just as normal as the rest of us. The best way to treat them, even those who may be unfortunately affected by harrowing experiences, is to make as little show of special consideration as is possible. We believe that the men of the mining industry and the veterans that want to be miners will know how to treat each other without requiring special instruction.

3. In most cases the adjustment to civilian status will involve the following considerations:

(a) G.I. Joe has lived in a world where food, clothing, and shelter were provided, and where he got along best by obeying orders without much exercise of his own initiative. As a civilian, the survival of himself and his dependents is again his responsibility, and he will get along best by a maximum use of initiative.

(b) In the armed forces he was surrounded by reckless waste of materials and equipment. The motive was to attain the objective; the material cost was secondary. Returning to industry, he may find some difficulty with the consideration given to the cost of equipment and supplies.

(c) Many of these men may have demonstrated particular skill or leadership in the services, but in ways that may not fully qualify them for better jobs than they left. It may be hard to step back to the old status. Any way in which the organization can give them a chance to demonstrate their fitness for promotion in due course will be helpful to both sides.

4. Where operations are unionized, there may be some basis for disputes over seniority. The veteran has legal rights whose details are still in dispute between the unions and Selective Service, despite recent rulings, and will no doubt be settled in the courts.

5. Organizations which are large enough will find it advantageous to set up some level-headed employees as veteran counselors. Their job will

be to familiarize themselves with the rights and problems of veterans and advise them properly.

6. Only 20 percent of veterans had jobs before the war. Obviously, we cannot assume that we have done our part simply by re-employing veterans who were formerly on the payroll. Somebody must employ the 11,000,000 veterans who had no job status before entering service. The individual employer is limited by his markets and costs as to the jobs he can provide. He can, however, be mindful of our common stake in attaining the fullest possible employment and accept a reasonable share of responsibility. Mass unemployment, if it occurs, will certainly twist our social-economic structure into a shape that none of us like to contemplate.

Those Termites Again

WE DO NOT BELIEVE that President Truman has any desire whatsoever except to carry out the obvious wish of the American people in fostering maximum private enterprise. However, a Presidential message to Congress is not a one-man job, and we are frankly disturbed over the wording of the passages quoted below from that part of the President's message of Sept. 6, entitled "17. Public Works and National Resources." In it we believe we discern the skillful hand of the power-hungry bureaucratic termites whom Mr. Ickes has persistently harbored, in a spot where, close to the central authority, they can further the Raushenbush philosophy of encroaching control over the nation's basic industries. The passages are:

"The depletion of our natural resources is even more startling. We have torn from the earth copper, petroleum, iron ore, tungsten and every other mineral required to fight a war, without regard to our future supplies. We have taken what we needed. We were not able to, and we did not, take account of tomorrow.

"At the same time, our splendid pre-war program to build up our national resources was sharply halted. The diligent and constant search for additional deposits of minerals was almost abandoned in favor of a frantic effort to discover and make possible the production of the materials of war."

" . . . We must proceed with all possible diligence not merely to restore these depleted resources to their pre-war standards but to make them greater and richer than ever before.

"We must make a diligent effort to discover new deposits of the precious and indispensable minerals upon which our national life is founded.

"We must develop for the use of industry new technologies so that the vast deposits of low-grade ores that have not heretofore been considered usable may be put to work for the good of all.

"It should be unnecessary to say that the conservation and development of the national plant must proceed according to an intelligent and coordinated design. The watersheds of this nation are not utterly independent, one of the other; our irreplaceable wealth of minerals, land and timber is not composed of segments which can effectively be dealt with separately. Any program of public works must have as its unifying purpose the greatest possible contribution to the wealth of the nation and to the wealth-producing capability of the nation.

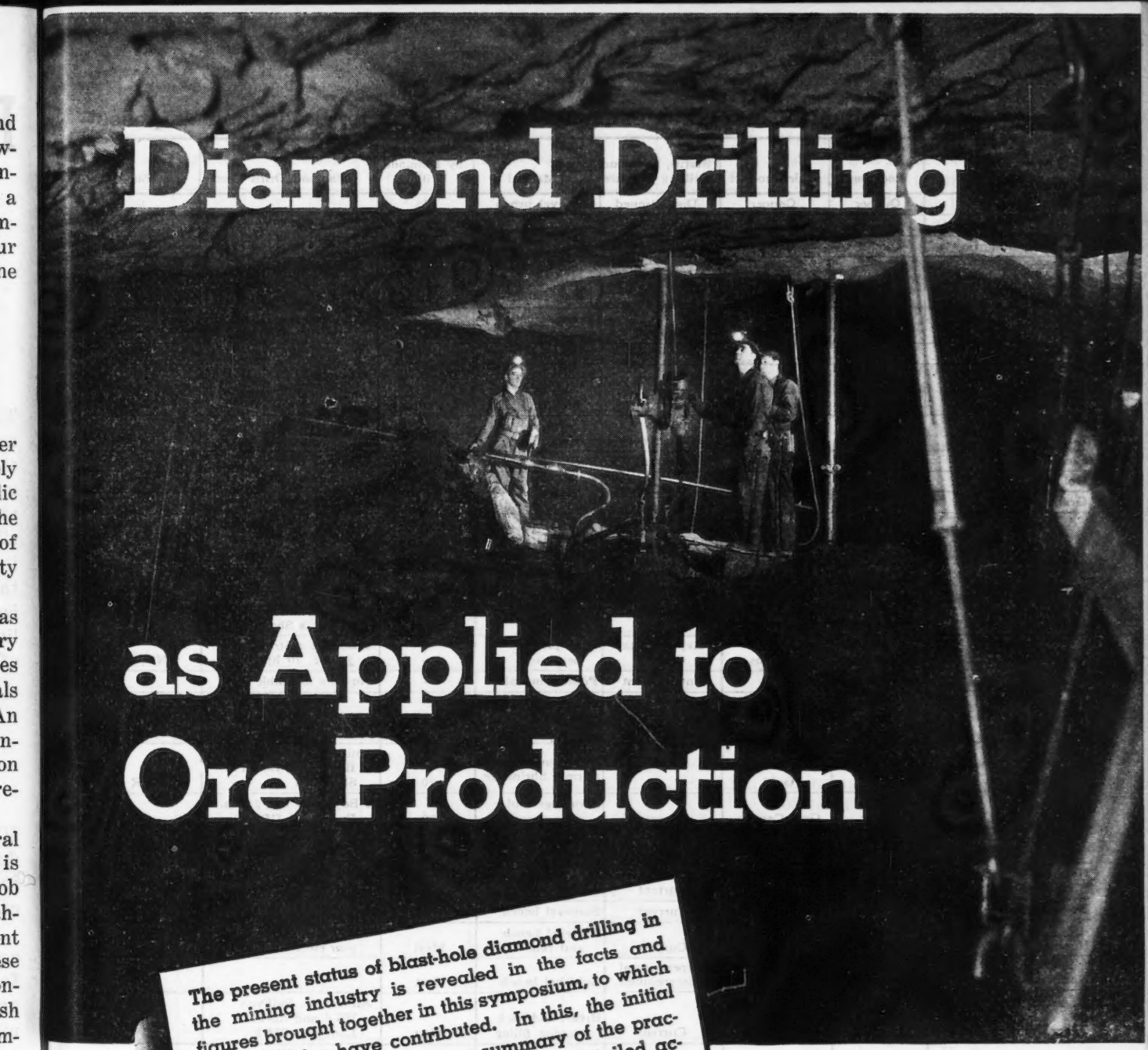
"It is necessary that we proceed as speedily as possible to set up machinery to make an inventory of our national wealth and our basic resources and to test the suitability of plans and proposals for public works in light of this purpose. An agency of this sort could provide us with consistent direction toward the goal of rehabilitation and improvement of our basic national resources."

Note that, despite the President's general friendliness toward private enterprise, there is nothing in these passages to indicate that the job of discovering new mineral deposits and technologies is anything but a task for Government bureaus and watershed authorities. What these termites would like—and under Mr. Ickes' continuance in office, are in fair shape to accomplish—is to keep private enterprise in mining hamstrung with tax burdens, so that they can point to a deficiency in technological progress and mineral discoveries, then proceed to undertake the job with taxpayers' money.

We believe that private enterprise in mining can be given the fullest encouragement consistent with common sense and that there will still be a bigger job than ever before for the Bureau of Mines and Geological Survey. However, we should like to see the Government end of the job done under the supervision of people devoted to American ideals, not by a group interested in using socialistic devices as a means of acquiring control over the nation's basic industries.

Mr. Truman could do the American people and the mining industry a great service by dumping Mr. Ickes overboard and subjecting the Interior Department to the same kind of housecleaning that the Labor Department is getting. After all, one can hardly sit on bad eggs without becoming a little fowl!

Diamond Drilling as Applied to Ore Production



The present status of blast-hole diamond drilling in the mining industry is revealed in the facts and figures brought together in this symposium, to which 40 companies have contributed. In this, the initial installment, are given, first, a summary of the practice of these operators, and, second, a detailed account of the electric core drilling done by Oliver Iron Mining Co. for production purposes in its Soudan mine. Other articles will follow.

DIAMOND DRILLING A PILLAR for demolition in a mine of Republic Steel Corporation at Mineville, N. Y., in the Adirondacks. The top of the pillar has first been cut off with a rock drill starting with set-up on the end of a cat walk hung from the back (seen at right). Note the air and water lines at left, carried up the face of the pillar to the diamond drill from the stope floor below. Photo by courtesy of Republic Steel Corporation.

USE OF DIAMOND DRILLS for drilling blast holes for breaking ore has grown considerably since a Canadian mining company, Noranda Mines, substituted them, in 1937,[1] for rock drills in the long-hole drilling scheme it had developed for stoping its wide and massive orebodies. A prime advantage of long-hole drilling lay in the better blasting results obtainable, and as longer holes became desirable the diamond drill logically replaced the rock drill with its sectionalized steel. This substitution by Noranda was a revival of a practice of the previous century, which had been used, in particular in the nineties, for drilling hard ore in the Soudan mine, in northern Minnesota, but later was stopped because diamonds became too expensive and better rock drills could be had.

Today diamond drilling is back in the work of breaking ground, primarily because bits have become cheaper. Mechanically set with cheap, small bortz instead of expensive carbons, ready-set bits have displaced the costly bits formerly used and are available on the market. Diamond drilling also permits

[1]See footnote 2, p. 71.

Mining Companies Using Diamond Drilling for Production Purposes—

Company	Location	Chief Product	Status, Diamond Drilling Practice	Method	% Output by Diamond Drilling	Diamond Drills Used	Bits*
Aldermac	Quebec	Copper	Discontinued	Sublevel bench	85		
Arntfield	Quebec	Gold	Discontinued				
Canadian Malartic	Quebec	Gold	Current	Sublevel bench	90	7 Boyles JV	C, NC, R.
Canadian Refractories	Quebec	Magnesite	Current	Sublevel ring. Also shrinkage and in sills	75	1 Canadian Longyear 3420. Also one Can. Long. Standard Chief	C, NC, R
Cananea Consol.—Republica	Mexico	Copper	Current	Sublevel bench Also pillars	Part	Sullivan 6 and HS-15. Also Chi. Pn. CP5	
Chesterville Larder	Ontario	Gold	?	Sublevel	Part	2 Boyles JV41	C
Consolidated M. & S.	B.C.	Lead-Zinc	Current	Sublevel ring. Also pillar mining	50	1 Longyear 3420. Eleven InterNational Multifeed TNT 500	C, NC, R
Dome	Ontario	Gold	Current	Sublevel ring	18	3 Can. Pneu. CP5	NC, R
East Malartic	Quebec	Gold	Current	Shrinkage	20	2 Boyles JV-41	NC, R
Golden Manitou	Quebec	Zinc		Pillars, ring	Part	Boyles JV	NC
Granby Consol.	B.C.	Copper		Pillar mining		Inter-National Multifeed	NC, R
Howe Sound—Chelan	Washington	Copper	Current	Sublevel ring. Powder-blast.	100	Boyles BBU, Jr. and Boyles electric; Longyear electric; CP5	NC 1 3/16 in.
Hoyle	Ontario	Gold	Shut down	Shrinkage. Sublevel	90	6 Boyles JV	NC, R
Hudson Bay M. & S.	Manitoba	Copper-Zinc	Current	Sublevel bench and ring	Most	11 Longyear 3420, 2 Heath & Sherwood	NC, C
Johnson's Company	Quebec	Asbestos	Experimental Current	Open-pit benching	—	1 Longyear Straightline Junior, 20 hp.	NC, R
Kerr-Addison	Ontario	Gold	Intermittent	Pillar removal	—	No data available	
Lapa-Cadillac	Quebec	Gold	Shut down	Sublevel bench and fans. One orebody only	Small part	Boyles Brothers—JV	NC 1 3/16
Matachewan	Ontario	Gold		Pillars only. Bench, ring. Shrinkage	20	Smith & Travers AM; Boyles JV; Heath & Sherwood	C, R
Mic-Mac	Quebec	Gold-Copper	Current	Shrinkage and open stope	20	2 Boyles JV and 2 Can. Pneumatic CP5	C
Mountain Copper-Hornet	California	Gold-Copper	Current	Sublevel ring	Part	1 Can. Pneu. Model A	NC
National Tunnel & Mines	Utah	Lead-Silver	Current	Sublevel ring and bench	Most	Longyear Prospector	Castset LM blast-hole type
New Occidental	Australia	Gold	Current	Sublevel bench		Boyles JV	Coring, 2 in.
Noranda Mines	Quebec	Copper-Gold	Current	Sublevel bench and ring	Most	2 Boyles JV; 2 Longyear electric; 1 CP5	NC, C, 1 15/64
Normetal	Quebec	Copper-Zinc	Experimental Discontinued	Sublevel bench	Part		
Oliver Iron—Soudan	Minnesota	Iron	Current	Breast and back stoping, filling	Most	All electric. Sullivan HS-4 and HS-10. Longyear FH-2.	C
Paymaster Cons.	Ontario	Gold	1939-'42, incl.	Sublevel bench	20	1 Boyles; 1 CP10; and 1 Longyear Chief	C
Phelps Dodge	Arizona	Copper	Experimental	Cut-and-fill			
Pickands, Mather-Anvil Palms	Michigan	Iron	Experimental	Sublevel		Air-operated drills	
Powell Rouyn	Quebec	Gold	Discontinued	Shrinkage	Small	2 Longyear, air	C
Republic Steel—Mineville	New York	Iron	Current	Sublevel ring and bench. Pillar mining	10-15	3 Chicago Penumatic CP5	NC, C
St. Joseph Lead—Balmat	New York	Zinc	One case, Now finished	Floor pillar in open stope	Small	1 Longyear, hp. 9. Cap. 275 ft.	NC
Sherritt Gordon	Manitoba	Copper-Zinc	Current	Sublevel ring and bench	30, formerly. 9, now	6 Boyles JV. Two Heath & Sherwood. 1 Can. Pneu. CP5	Coring mostly, 12 9/32 Non-coring
Siscoe	Quebec	Gold	Current	Sublevel bench. Shrinkage	34	1 Boyles BBU, Jr. and one JV	C
Sladen Malartic	Quebec	Gold	Current	Sublevel bench and ring. Also in shrinkage	90-95	5 Boyles JV5—Model 41	NC, R
Tennessee Copper	Tennessee	H_2SO_4 Copper	Current	Sublevel. Pillar mining	50	Chicago Pneu. CP5 and Sullivan HS-15.	C, NC
U. S. Vanadium Rifle, Colo.	Colorado	Vanadium	Experimental Current	Sublevel ring. Pillar mining	—	2 Longyear D6M	NC
Bishop, Calif.	California	Tungsten	Current	Slabbing and Sublevel ring	80	1 Chicago Pneumatic CP5	C, NC
Waite-Amulet	Quebec	Gold	Current	Sublevel	Large part	1 Boyles JV41	NC, C

*C, coring, NC, non-coring, R, reamer. (a) Contractor's price. (b) Not final until sill is blasted. (c) Should be lowered when regular diamond-drill mining is undertaken. All blasts thus far on old faces. (d) Total over-all diamond-drill stoping cost compared with $2.36 for standard stoping methods. (e) Three figures for three working areas. (f) Four figures for four areas. (g) 1.80 undercutting, 4.0 breaking ore.

Significant Data Supplied by Operators

Size of Hole, In.	Burden, Ft.	Feet Drilled Per Shift	Tons Broken Per Foot	Cost Per Ft. Dollars	Powder	Powder Pounds/Ton
1 3/16	6	70	4.54	0.51		0.72
1 1/2	5-7	45	2.4	0.70 (a)	40% Forcite	0.45
1 3/16-1 1/2	6	75-150	3-4	0.20-0.30	"	0.38
		43-65	3.54	0.45-0.485		0.185
1 1/2			2.37	.60-.70(a)		0.32
1 3/16	7-7.5	86	3.50	0.38	70 and 75% Forcite	0.17 (prim.) 0.02 (sec.)
1 1/4	5-14	48	1.5-2.5(b)		40 and 60% Forcite	.01-.04, prim. .03-.05 sec. (b)
1 1/2	4	50	2.1	0.60	40% Forcite	0.136
1 1/2		40-60		0.65(a)	75% Forcite	0.25-0.33
2 7/8		14	17-20			0.15
1 13/64		45	1.80-4.0(g)			
1 3/16	3-Shrinkage 5-Sublevel	40	2.0	0.50-0.55	40% Forcite	2.5-3.0 prim. 2.5-3.0 sec.
1 7/16	6	86	5.0	0.337	"	.138-.156
1 15/16	14	60	5.41	(c)0.45	"	0.18
		57.5	2.61 (overall) 2.92 (without slot)	0.61		0.27 (overall) 0.246 (without slot)
	5 1/2-6	35	2 1/2-3	0.65-0.85(a)	40 and 75% Forcite	.20-.27 prim. .12-.31 sec.
1 3/16	3	50-55	1.4		75% Forcite	0.62
1 1/2	7	50				
1 1/2 O.D. 1 3/16 O.D.	6-8-10	38-40 (av.)	4.77 (1944) 3.55 (1945)	.915-$1.25 (a)	45% Gelatin Some 60%	.15 (1944) .20 (1945)
2+		17	5.95	13s. (a)	75% Gelatin	0.27
1 3/16	6	72	3.67	0.28	40% Forcite	.181 prim.
1 1/2	3 (breasting) 3(back stoping)	30				
1 3/16	3	40	1.25	0.20	40% Forcite	0.55
1 1/2	6-8		3.75	0.60	40% Forcite	
1 1/2	5 (in rings)		11.6 (pillar) 3.33 and 4.8(e)			0.057 (pillar) 0.20 and 0.15 (e)
1 1/8			3.0			0.5
1 15/16	6-10	35	5.1 and 3.75 (rings)	1.20	60% Forcite	0.32 and 0.297 (rings)
1 3/16	4		2.3	0.57	40% Forcite	0.705
1 3/16	3 1/2-4-5 (rings)		2.2; 1.0 in rings. 2.35 shrinkage	(a).70		0.385; 0.840 0.79; and 1.03 (f)
	4 1/2-6		4.0	0.55	1 1/4x12-in. 40% semi-gel.	0.15
1 1/2	4-5	52 1/2	1.19	(a).75		
1 3/16		52	2.88	1.10		
1 1/4	6	113	4.0		40 and 75% Forcite	0.15 (pri.) 0.22 (sec.)

[2]Noranda Mines, Ltd., took the first step in this direction when it substituted diamond drills for hammer drills for pillar extraction in September, 1935. It adopted diamond drills for routine sublevel stoping in siliceous fluxing ore in January, 1937.

more efficient and safer mining, as well as cheaper, where the ore conditions are favorable.

Blast-hole diamond drilling has long since passed the experimental stage. Its adoption proceeded rapidly in Canada for a time after the revival, Noranda pioneering[2] the way, and by 1942, if not somewhat earlier, 20-odd companies there, were employing it.

In the United States at the Soudan mine, scene of the earlier practice, the Oliver Iron Mining Co. soon began experimental drilling (June 1939) and decided to operate its drills electrically, an interesting innovation. Since then its practice along this line has become well developed. Up to the present, ten mines in this country have employed diamond drills for blast-hole work. The total number of companies for the United States, Canada, and elsewhere abroad is in the neighborhood of 40.

These companies are listed opposite,* with salient data regarding the blast-hole diamond drilling practice of each. Most of them use both diamond drills and rock drills for stoping, their use of the former accounting for a varying percentage of their total drilling, because only part of their ore, whether in one body or several, can be thus worked. The practice also readily lends itself to mining pieces of ground of limited size, which might otherwise never be recovered, because of unsafe conditions or other reasons.

Steep Rock Iron Mines, Ltd., Ontario, has been omitted from the tabulation despite the notable diamond-drilling work done in excavating the west Raft Lake cut in the water-diversion scheme, because this drilling was not done for direct production purposes.

In addition to the companies tabulated, some others are recently reported to be using or experimenting with blast-hole diamond drilling. Included are the M. A. Hanna Co., at DeGrasse, N. Y.; Alan Wood Steel Co., at Dover, N. J., and Bethlehem Steel Corp., at Cornwall, Pa. The total number may reasonably be expected to increase as other operators seek to make use of this drilling method.

The kind assistance of the many mining companies and manufacturers who have contributed the data and other information appearing in this issue, and which will be published in future

*Data pertaining to the International Nickel Co. of Canada were received too late to be included, but they will be published subsequently.

issues is gratefully acknowedged. The information tabulated respecting the practice of New Occidental Gold Mines is taken from an article by Blackett and Creelman in the Proceedings of the Australasian Institute of Mining and Metallurgy, March 31, 1945. On page 72 we have tabulated the advantages and disadvantages of ring drilling and bench drilling as recounted by C. P. Browning in a recent address before a local section of the Canadian Institute of Mining and Metallurgy.

The Machine's Advantage

The diamond drill possesses two primary advantages over the rock drill:

1. Its ability to drill long holes efficiently and with the use of ready-set bits to do this at a reasonable cost per foot.

2. Its ability to drill holes at any angle around a full circle of 360 degrees, this from a single set-up.

It is on these two abilities that its value for stoping ore primarily rests.

Against these advantages, the diamond drill costs considerably more *to buy* than the rock drill. Moreover, so long as it is operated by air, it is in approximately the same class as the rock drill so far as the efficiency of this form of power transmission is concerned.

Two secondary advantages of the diamond drill, as compared with the rock drill, are:

1. Less noise in operation.
2. Avoidance of dust.

These advantages of the machine speak for themselves.

Advantages and Disadvantages of Bench Drilling and Ring Drilling

	Advantages	Disadvantages
Ring Drilling—Vertical (Vertical slice) The "Noranda System"	1. Safety. Men work in drift. 2. Holes drilled from one set-up. 3. Drilling can proceed without interruption. 4. Supervision minimized.	1. Vertical slice when shot delivers to only two or three drawpoints at a time. 2. Holes in ring concentrated near collars, giving waste footage. 3. Net tonnage less per foot of hole.
Bench Drilling (Vertical slice) The "Aldermac System"	1. Safety. Men on bench under cover. 2. Hole-spacing uniform with uniform load for blasting. 3. All down holes, costing less to load.	1. Advance drilling limited, as bench cannot be extended far from open-stope face, lest it weaken block overhead. 2. Drillers work close to edge of open stope, where there is danger from sloughing and from stumbling. 3. Drill has to be moved for each hole. 4. Vertical slice when shot delivers to only 2 or 3 drawpoints at a time.
Ring Drilling—Horizontal (Horizontal slice)	1. Preliminary development in block is a minimum. 2. No vertical blasting slot required. 3. Entire stope may be drilled ahead of blasting. 4. Horizontal slice when blasted delivers to all draw points. 5. Gravity helps, so that burden may be increased. 6. If broken ore is drawn low, the fragmentation is greater than with the vertical slice taken in first two methods.	1. Greater care needed to make raise set-up safe. 2. Only one machine in raise at a time. 3. Drilling from raise more difficult than in drift in vertical ring drilling or on bench in bench drilling. 4. More difficult to line drill holes than on sublevel set-ups in other two methods. 5. Drilling interrupted to load blast holes. 6. Hoist tied up at each raise to move drill carriage.

Advantages of the Method

The advantages of blast-hole diamond drilling, without reference to their relative importance, are:

1. Safety. Heavy ground can be mined without exposing the men. The back can always be tested.

2. Cost improvement possible. Development expense is reduced. Tonnage broken per machine shift is bigger. Less labor is required. Supervision is easier.

3. Blasting of drilled ground may be deferred until ore is needed, the ore meanwhile serving as a ready reserve without being exposed to oxidation.

4. Plans can be made better for continuous operation. Advantage may be taken of easy labor and power conditions to drill in advance, this also insuring production maintenance against possible labor shortage later.

5. Better blasting, lower powder cost. Powder can be better distributed in hole and the burden apportioned for best results. Blasting can be done at the week-end, avoiding dust and fume, or when most convenient. Also, the more uniform hole permits quicker loading, more even distribution of powder. Walls after blasting are better.

6. Fewer skilled workers are required. Diamond drill runners can be trained more easily than miners.

7. Remnants of ore, pillars, and irregular masses can be mined which might otherwise have to be left. Occasional bulges in an orebody are readily handled.

8. In a special case of very hard ore the diamond drill has proved faster than the rock drill.

Principal disadvantages are:

1. Much more water is used in diamond drilling, so that there is more sludge washing through onto the haulageways to be cleaned up.

2. There may be difficulty at times in keeping the longer holes going in the direction desired.

Three Ways of Drilling

Blast-hole diamond drilling is in itself not a method of mining but a method of drilling. In its application to stoping it has brought about variations from normal procedure in established mining methods, as in reducing the amount of preparation required, and has improved the results, as, for example,

in increasing the tonnage broken per man-shift.

Three variations of diamond drilling procedure have been developed. They are:

1. **Bench drilling**, in which a bench is developed by slashing with a rock drill to the walls, and a row of down holes, evenly spaced, is drilled by the diamond drill along the bench at a uniform distance back from the edge to give the desired burden.

2. **Vertical ring drilling**, in which a fan or ring of vertical holes, each hole being of predetermined length and angle, is diamond-drilled from a single position in a drift or other opening.

3. **Horizontal ring drilling**, in which a ring or fan of horizontal holes is drilled from a single position in a suitably placed raise.

A modification of (2) and (3) is ring drilling, in which the plane of the ring is inclined, instead of horizontal or vertical. The method is otherwise the same.

In both bench drilling and ring drilling a free face must be provided to which the successive slices can be broken. This is usually done by cutting a slot with rock drills across the ore deposit by shrinkage or other means.

The mining method to which blast-hole diamond drilling has been most commonly applied is sublevel stoping. It is also used in connection with shrinking, open stopes, room-and-pillar, backstoping and filling, cut-and-fill, and "powder-blast" stoping.

Pillar mining or demolition is a common application of blast-hole diamond drilling.

Conditions for Use of Blast-Hole Diamond Drilling

The conditions favoring the use of diamond drills for blast-hole work are in general naturally the same as those for long-hole drilling. The ore must stand well in large open stopes,[1] be of good width and of steep dip, with strong regular walls. Within these wide limits there will be found, on the one hand, soft, fast-drilling ores, like sulphides, which can be drilled with non-coring bits and light, fast machines; and, on the other, hard siliceous ores which must be drilled with coring bits driven by rugged, high-powered machines.

In some properties there may be only one orebody or section that lends itself to diamond drilling.

[1]C. H. Hopper, CIMM, Dec., 1943, p. 481. Also partly in letter to editor.

At the same time the use of the diamond drill in some mines may be considered as not following a fixed mining pattern, the machine instead being simply a means of doing drilling for mining purposes which cannot be accomplished by the ordinary rock drill.

The Electric Machine

Diamond drills used in blast-hole work may be divided into two groups, according as they are driven by compressed air or electrically driven. Although most of the footage diamond-drilled today for blasting purposes is drilled with air-driven machines, the electric drills have a peculiar interest, representing a departure from "orthodox" air drilling that suggests the possibility that an efficiency in rock drilling heretofore unrealized with pneumatic equipment may eventually be realized through electrification. However this may be, the electric drilling and the machine used at the Soudan constitute a special case.

The study presented, which will be continued in following issues, will also cover the operations of some of these companies in more detail; particularly where they have special interest.

DIAMOND DRILLING AS APPLIED TO ORE PRODUCTION

Electric Core Drills Stope Soudan's Hard Ore

DIAMOND DRILLING of blast holes at the Soudan mine is not new. This method was first resorted to in the early nineties because of the hardness of the ore.

The technique then employed was similar to that of the exploration drilling of the period. Air-operated diamond drills adapted to the job were used; bits and rods were the same as those used in the exploration work then going on in the Soudan district. The bits were of the hand-set carbon type. This method of drilling was discontinued about 1900 due to the rise in prices of black diamonds.

In 1938 the attention of the management of the Oliver Iron Mining Co., which owns and operates the Soudan, was drawn to a new technique in the manufacture of core bits that merited investigation and led to experimental drilling. Electrical operation was decided upon for the drills. The seven years that have elapsed since then have seen the development of the present drilling technique, as well as that of the drill and bits employed.

The hardness of the ground in the Soudan mine can be gaged by the drilling performance of pneumatic percussion drills using detachable bits. Drilling speed with percussion-type rock drills averaged only 0.5063 in. per minute for a one-month period—December 1939—and a bit drilled only 3.06 in. before being discarded.

As against the average drilling speed of 0.5063 in. per minute for the month, the high figure was 1.5 in. per minute and the low figure 0.125 in. Simi-

larly, the high figure for bit service for the month was 18.409 in. of hole per bit and the low figure 1.538 in., compared with the average of 3.06 in.

These figures were taken from a report prepared by W. L. Kendrick, dated Jan. 30, 1940, on the performance of percussion-type air drills. Nine different stoping areas were covered.

The Drills

ELECTRIC OPERATION of the diamond drills was decided upon because of the high cost of compressed air as compared to electric power and the ease of getting the latter to the working place.

Types of electric diamond drills used for stope drilling today in the Soudan mine are as follows:

Sullivan HS-4, 3.75 hp.; capacity, 120 ft. of 1½-in. hole (opinion, no other ratings being available); weight 190 lb.

Sullivan HS-10, 5 hp.; capacity, 200 ft. 1½-in. hole, weight 230 lb.

Longyear FH-2, 7.50 hp.; capacity, 200 ft. of 1-in. hole; 250 lb.

Sullivan HS-4 and 10. Both machines are direct electric drive, and are similar in design except for difference in size of the electric motor. Castings are of aluminum and the hydraulic cylinder and slide tube are of stainless steel. The machines have a hydraulic bit feed with a cylinder having an effective area of 14 sq.in.

The HS-4 has a hand feed of 15 in. and a hydraulic feed of 17 in. for a total run of 32 in.

The HS-10 has a hand feed of 12 in. and a hydraulic feed of 15 in. for a total run of 27 in.

Longyear FH-2. This machine is operated by an oil-driven motor. The body consists of aluminum casting, with twin hydraulic cylinders of brass, and piston rods of stainless steel, all mounted in a cradle made of steel castings. These machines, also, have a hydraulic bit feed with a total run of 20 in. The twin cylinders have an effective area of 8 sq.in.

No important changes in design of the three types have been made since 1939. The Sullivan drills have had bushings installed in places subject to excessive wear; the Longyear machines have had the bit water swivel changed from the chuck end of the machine to the inside of the housing.

New Sullivans of 1943 model are on order having only a hydraulic feed of 20-in. run, eliminating the hand-feed with its many parts.

TYPES OF MOTORS USED have not been changed except that the Sullivan HS-4 stator was at first wound for two speeds—1,800 and 3,600 r.p.m. At present they are wound for only 1,800 r.p.m.

The types of motors now in use in the three drills are as follows:

HS-4 drills—3.75 hp., 440 v. 60 cycle, 3 phase, 1,800 r.p.m. Type KY-39, totally inclosed, fan-cooled, ball-bearing, Class B insulation, squirrel-cage induction type.

HS-10 drills—5 hp., 440 v. 60 cycle, 3 phase, 1,200 r.p.m. with other features as in the HS-4.

FH-2 drills—The drive on these drills is a variable-displacement, oil motor developing 7.5 hp. at 1,500-psi. oil pressure, and allowing a stepless variation in speeds from 800 r.p.m. to 2,800 r.p.m.

The motor is driven by oil under pressure supplied by a vane-type, continuous-flow pump, which in turn is driven by a 7½ hp. a.c. electric motor coupled direct. Pump and driving motor are mounted as a separate unit with hose connections of any suitable length to the drill machine. These hoses are of the grease type and suitable for high pressures, the high-pressure hose being ¾ in. in diameter and the return hose 1 in.

This type of drill machine drive was developed to provide variable rotational speeds, so necessary where hardness fluctuates.

Bringing Power to Drills

Power for all uses is brought from the surface down the shaft over a No. 2 B&S., 3-conductor, armored cable at 2,300 v. It is stepped down to 440 v., the voltage at which all equipment underground operates except the light circuits. From the substations a heavy 4-conductor trunk line transmits the power, usually to, or beyond, the last working place off the main drift.

Junction boxes on the trunk line are placed at, or near, the entrance to each stope. From these a 4-conductor rubber-clad power cable enters the working place. This cable is size No. 4, No. 6, or No. 8, depending on the power needs within the particular stope, and terminates at a main switch, which is a 3-pole, single-throw, fusible, switch box mounted on a rack along with other switch boxes, each servicing a single machine in the stope, such as a scraper motor, a hoist, or an electric drill. The main switch is connected to each switch box. These are 3-pole, single throw, and fused.

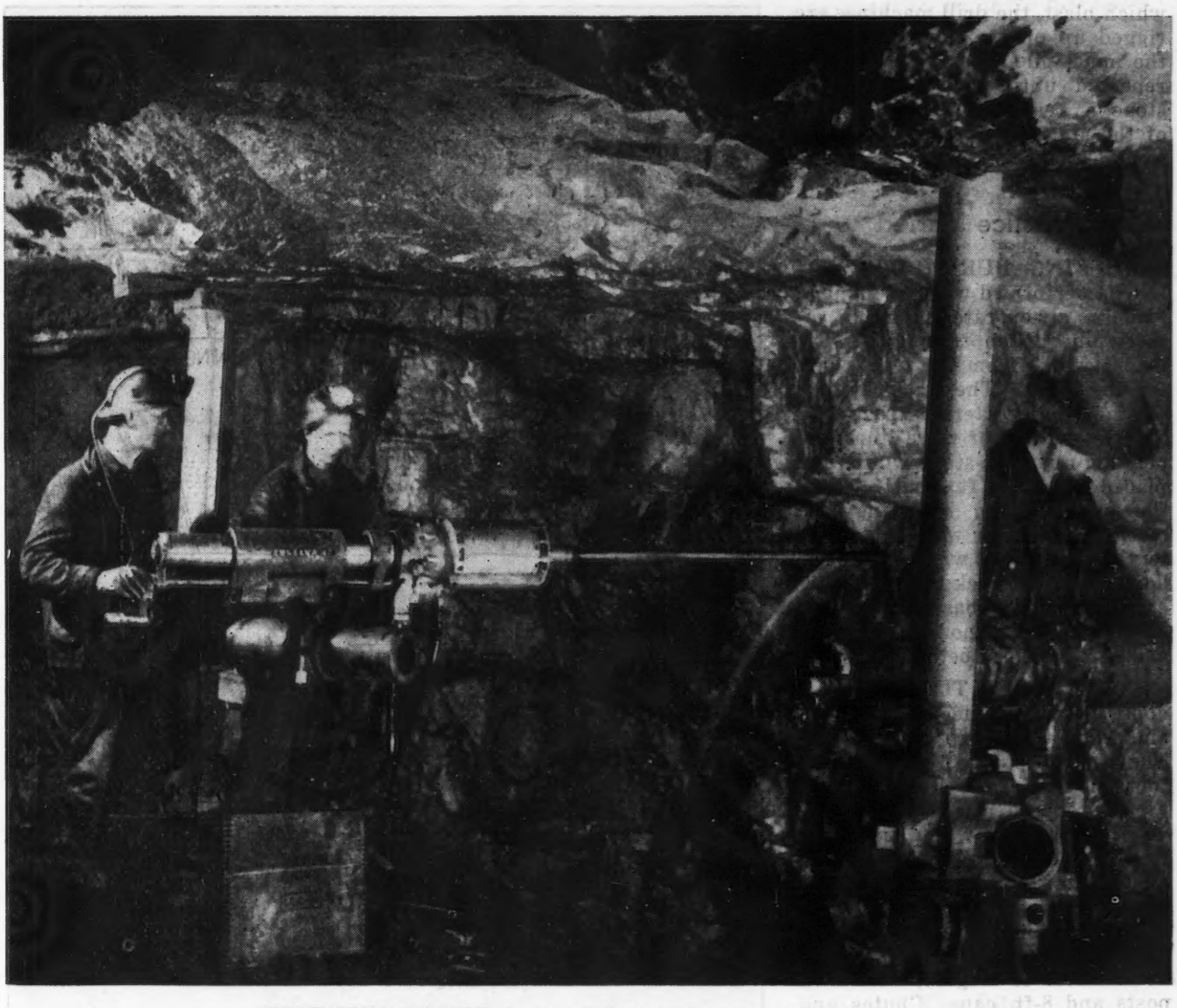
The service switch for an electric drill is fused for 30 amp. From it a No. 10, 4-conductor, rubber-clad cable about 300 ft. long leads to a second 30-amp., 3-pole, single-throw switch mounted on a movable stand, on which is also mounted a magnetic 3-pole switch equipped with heater strips. These two switches are placed back to back with No. 10, 4/c connection cable between. From the magnetic switch a No. 10, 6/c, rubber-clad cable 200 ft. long leads to an auxiliary 5-pole single-throw switch box built to withstand rough handling and water. This auxiliary switch is near the drill, to which it is connected by a No. 10, 6/c, rubber-clad power cable about 25 ft. long. The cable is fastened permanently to the switch. Onto its machine end is molded a rubber Miller plug, the male half of which is on the drill.

In another arrangement for feeding power to the machine, and which is gaining favor, a 4/c cable runs from the first service switch to the second service switch, which is at base or top of the raise leading to the working level of the stope. From the second switch another 4/c cable leads to a 3-pole unfusible switch, mounted back to back with the magnetic starting switch, on a portable stand. The 4/c cable has a Miller plug, the male half attached to the unfusible switch box. A 6/c, No. 10 power cable to the drill machine is permanently attached to the magnetic starting switch with the standard Miller plug on the machine end of the cable as before.

With this, the equipment is much more easily removed from the working face at blasting time. It also reduces the length of 6/c cable as used in the other system to only 25 ft. between the drill machine and the starting switch, and eliminates the auxiliary switch. The portable switch stand and 25-ft. length of power cable is one unit of the feeder system, and the 4/c cable from the second service switch to the portable switch stand is another.

The Mining Method

BACK STOPING AND FILLING is the method employed for mining the Soudan ore. Operating levels are 200 ft. apart vertically. The orebodies vary up to 70 ft. in width or thickness, and up to 500 ft. in



ELECTRICALLY OPERATED diamond drill at work in a stope of Soudan mine.

length. The vertical height is usually greater than the length. The walls are usually sericite or chlorite schists, i.e., greenstone.

BREAST STOPING is employed at the start to prepare for subsequent backstoping. When an orebody is broken into by a drift or crosscut, the operation is widened out in the ore, to make more room, and is continued across the width of the deposit. Breast stoping is thus begun, and eventually the ore is removed the full length and breadth for 24 ft. above the track.

DRILLING JUMBOS upon which are mounted pneumatic drifters are used when drifting in rock at Soudan. When the orebody is reached, the jumbo is re-equipped with electric drills and continues across its width for a height of about 14 ft. When this widened-out room is completed, the breast stoping proceeds towards one end of the orebody. The jumbo-mounted electric drills are used to make a cut in the ore adjacent to either wall. This cut, resembling a drift, is advanced in the ore about 20 ft., which requires two or three cuts. After this opening is made, the drilling operation proceeds towards the opposite wall by a series of "sidecuts," drilling 18- to 20-ft. holes spaced about 6 ft. apart on the horizontal, and about 3 ft. on the vertical plane. The round is blasted towards the initial opening. This procedure is repeated, traveling from side to side with the sidecuts, and advancing with each series until the end of the orebody is reached. The other end of the orebody is worked out in the same manner.

REMOVING THE BACK to the desired 24-ft. height when the ore is stoped to the height of 14 ft. begins at a point opposite the drift, or crosscut, opening into the orebody. This operation is still considered "breasting"; ("back stoping" starts after the stope-drift timber is placed). From the jumbo platform, upper cut holes are drilled in the back across the breadth of the narrow stope, or for a distance of about 30 ft. This opening cut in the back is accomplished by drilling a series of inclined holes converging towards each other to simulate a "V" cut. When this area is blasted down, the muck pile then provides a bench upon which the drills can be rigged with a post and arm set-up, and from which horizontal holes are drilled 18 to 20 ft. deep in the exposed working face. Usually two rows of holes are sufficient; the top row is placed close to the back, and the other about 3 ft. lower. The holes are spaced about 6 ft. apart in the rows. It is the desired practice to drill all the holes across the width of the stope before any are blasted; after

which blast, the drill machines are rigged up on the new portion of the muck pile, and the process is repeated until that end of the stope is reached. The other end of the stope is worked out in the same manner.

Practice Varied

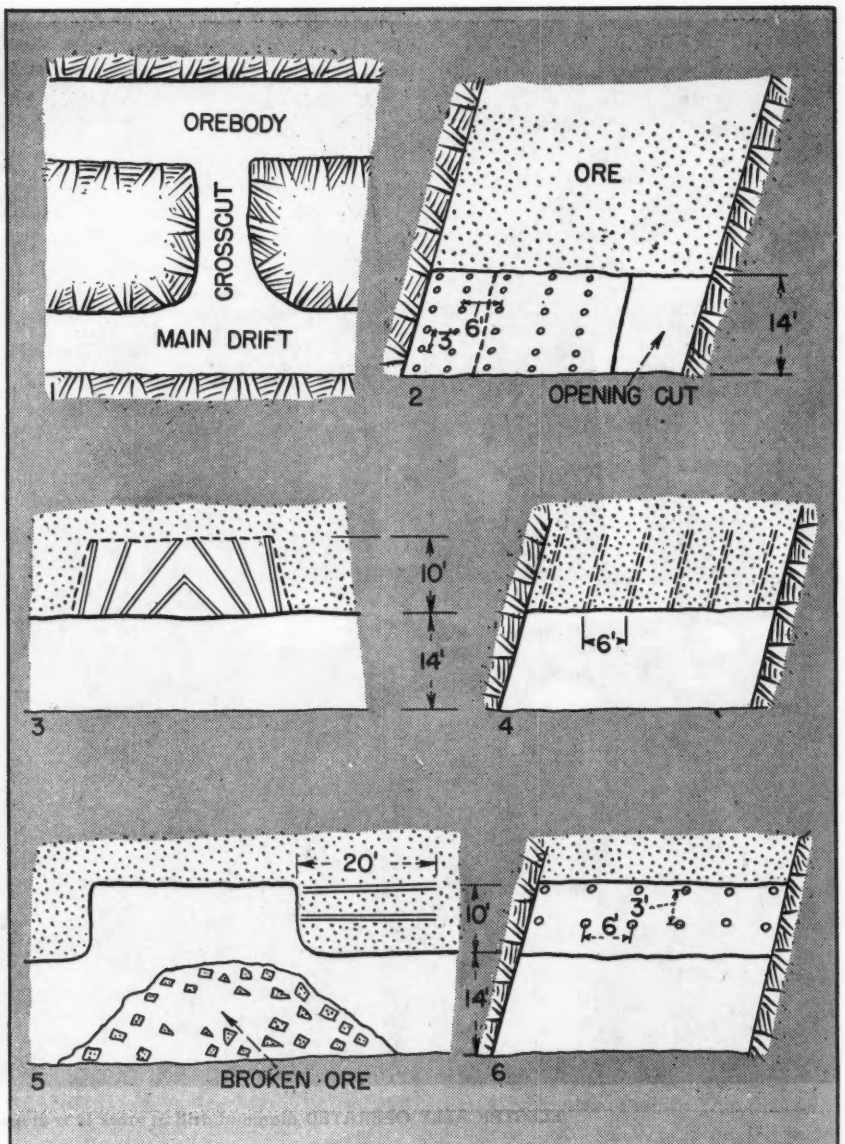
MUCKING DURING BREASTING is performed with mechanical loaders, air-operated, loading directly into 3-ton tram cars. The loader works from the tracks laid for the jumbo. The tracks branch off the single entering track into a series of two or more lines, depending upon the stope width, and placed about 10 ft. apart. When the jumbo is on breasting, the mechanical loader works intermittently with it, but when drilling is done from the muck pile, the loader works at the base of the pile so that always enough muck remains to support the drill.

STOPE-DRIFT TIMBERING is done after breasting is completed and the muck is all cleaned out. The timber is stood close to the footwall side of the stope to allow the chutes and raises to continue *vertically* upward. The timber is well "side-braced" to make it stand; chutes, manways and service raises are also started.

The timber is size 12 or better (that is, the small end is 12 in. in diameter or larger), with 9-ft. posts and 8-ft. caps. Chutes and raises are crib-constructed, the cribbing being 8 to 10 in. in diameter and 7 ft. long. The manways are placed on the hanging-wall side of the drift, about 50 ft. apart. Chutes are placed opposite the manways, with an extra one between these. The two or more service raises are located so as best to serve the stope. The drift timber is heavily lagged with 16-ft. poles, on the top and sides. After the timber is all placed, the stope is then backfilled with waste rock brought into the stope, through "rock raises," from above.

ROCK RAISES are driven in the rock wall of the stope to the level above, preferably in the footwall, following the contact of ore and rock. They are driven in rock because of the ease in drilling compared to drilling in ore. The number of rock raises depends upon the length of the orebody, but they are spaced not much over 200 ft. apart and so placed that one is about 100 ft. from *its* end of the stope. The tops of the raises are engineered to be at a convenient place for using the fill from the worked-out stope above, and for dumping in development waste.

The waste brought into the stope is spread as fill with 40-hp. electric two-drum, tugger-operated scrapers and completely covers the installed timber to a height of 6 ft. from the stope back.



BREAST STOPING as practiced in Soudan mine is shown in successive steps:

1. Crosscut, in plan view, enters orebody. It is widened out with electric drills mounted on jumbos and continued to opposite wall. Breast stoping is then continued by driving along strike in one direction, starting with opening cut.

2. Opening cut is made along one wall, as seen in this vertical cross-section, and is continued for about 20 ft. It is then widened to opposite wall by side cuts with rows of holes 6 ft. apart, the holes being 3 ft. apart in each row.

3 and 4. Starting opposite the crosscut, the back is then drilled for a V-cut, as shown in these two views, to provide a face for advancing either way to take the back to a height of 24 ft.

5 and 6. Advancing along the strike from the V-cut the rest of the back is taken to 24-ft. height, the electric drills being mounted on the muck pile. This completes the "breast" stoping operation.

Back Stoping Begins

BACK STOPING starts at a point opposite one of the rock raises, when the stope, or a part of it, is satisfactorily backfilled. It begins with an opening cut, similar to that used when the removal of the back in breasting was started, by drilling inclined holes in the back to simulate the "V"

cut. This opening cut is made to produce a working face about 14 ft. high, into which will be drilled the horizontal holes 18 to 20 ft. deep. Sometimes it is necessary to drill and blast two times in order to gain the desired height of this opening cut.

From the top of the muck pile, resulting from the opening cut blast, drilling proceeds towards the far end of the stope. The drill machines are post-and-arm mounted. Two rows of horizontal holes about 20 ft. long are drilled in the working face. One row is close to the back, the other is about 3 ft. lower. The holes in each row are spaced about 6 ft. apart. This procedure, again, is a repetition of what was described in an earlier operation of bringing down the back during breasting.

As it is not possible to drill three rows of holes from the muck pile, it is necessary that another set of holes, called "uppers," be drilled into the back and ahead of the "collar" to relieve the heavy burden on the bottom row of horizontal holes. (The "collar" referred to is the working face exposed on the opening cut blast.) The drilling of "uppers" is done from the top of the fill. The holes are spaced about 6 ft. apart in rows running across the width of the stope, and the rows are also about 6 ft. apart. The holes are inclined toward the collar at about 45 deg. from the horizontal, and about 10 ft. long. This phase of drilling usually is a continuation of the drilling for the opening cut, and thus becomes well advanced ahead of the horizontal hole drilling in the working face.

SCRAPING is used for mucking the ore produced in back stoping to the ore chutes. The scrapers are set up with two head blocks fastened in the back, one on each side of the stope, in pin holes drilled near the collar before blasting that collar. With cable rigging from a 25-hp., 3-drum, electric hoist, running through the two head blocks, the scraper can operate for the full width of the muck pile. Mucking starts as soon as a sizable pile is obtained, and continues through the drilling cycle, but not to the point where the drill mountings, on top of the pile, are disturbed.

As the drilling, blasting, and mucking operations progress, the raising of chutes and raises follow, to be followed, in turn, by backfilling of the stope—whcih backfilling has been described.

Setting Up the Drills

DRILL MOUNTING proceeds as follows: The drill jumbo is equipped with two posts made of standard 3½-in. pipe (outside diameter 4 in.). The posts have a single jack screw on the bottom, and a sliding inside pipe so arranged that the posts are telescopic. The posts can be adjusted for various heights within their range of 12 to 16 ft. An arm 4 in. in outside diameter is used with them, and equipped with a saddle to receive the standard 5-in. cone.

When the drills are not used on a jumbo, they are mounted on a single 5-in. (O.D.) post having a double jack screw. Both post and arms are made of standard 4½-in. pipe, the post being made up in 5- and 7-ft. lengths and the arms in 3- and 5-ft. lengths.

In setting up the drills, the Sullivan machines are placed so that the post is about 6 ft. from the working face and the wall; then with the aid of the arm, the machine can be slid or swung to the desired position. The Sullivan cannot drill a hole parallel to the side wall if the drill is closer than 8 in. from the side wall. This clearance is necessary to tip the machine out of drilling position while changing rods. The Longyear machines can be set so that the post is as close as 2 ft. from the face, but it needs 14 in. of clearance, on the side, to allow swinging the machine out of drilling position, while changing rods when drilling holes—parallel to the wall.

When the drilling is completed, the drills and other equipment are carried over and down the muck pile, and, at a safe distance, are protected from the blast by covering with timbering material.

Crew and Work Cycle

A DRILL CREW consists of one runner and one helper when only the one machine is working in a stope. With two or more machines in the same stope, there is one helper for the group.

In any one stope the number of machines working is dependent on its size. At present there are two machines working in one stope which has an average width of about 40 ft. In each of the two other stopes, the average width being about 60 ft., three machines are used.

The operating cycle does not take place within an eight-hour shift, but, rather, during a week's period, the time depending entirely on which phase of the stoping operation is under consideration. No time studies have been made, because of irregularity of the work.

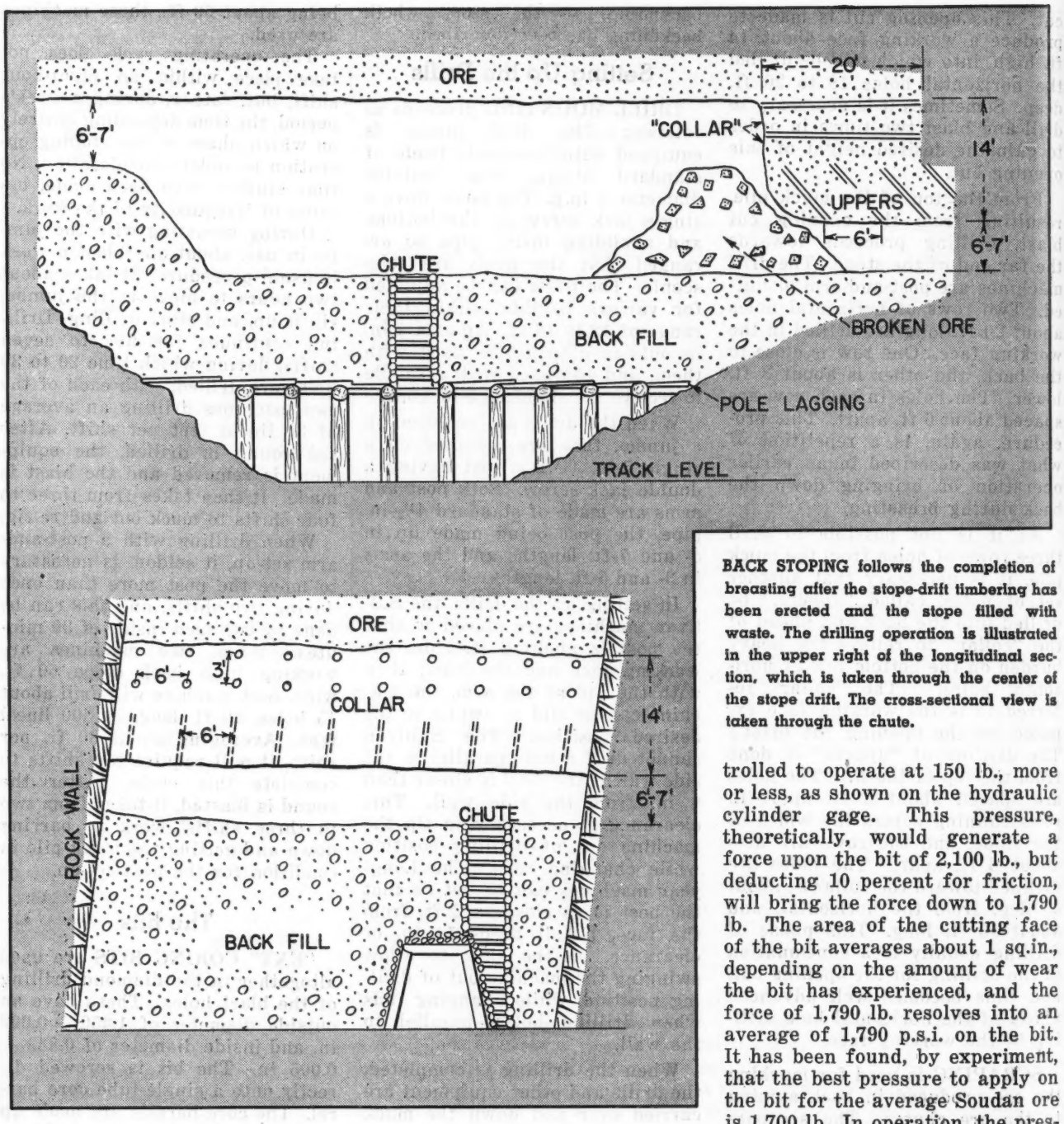
During breasting with the jumbo in use, about one blast a week is usual procedure. It takes about two hours to move in the jumbo, rig it up, and start drilling. Drilling continues for five to seven shifts, during which time 20 to 30 holes are drilled, with each of the two machines drilling an average of 30 lineal feet per shift. After the round is drilled, the equipment is removed and the blast is made. It then takes from three to four shifts to muck out and re-rig.

When drilling with a post-and-arm set-up, it seldom is necessary to move the post more than once during two shifts, and this can be done by two men inside of 30 minutes. When two machines are working in a back stope 60 ft. wide, each machine will drill about 15 holes, 20 ft. long, or 300 lineal feet. Averaging about 30 ft. per shift, it will require ten shifts to complete this cycle. After the round is blasted, it takes from two to three shifts' work in barring down and getting the muck pile in condition for the next set-up.

The Bits

"EXT" CORING BITS are used altogether in the diamond drilling of the blast holes. These have an outside diameter of 1.450 ± 0.002 in. and inside diameter of 0.843 ± 0.005 in. The bit is screwed directly onto a single-tube core barrel. The core barrels are made up in 18- and 36-in. lengths of 1⅜-in. No. 10 gage tubing No. 4130 SAE, with a core barrel head 3½ in. long made of 1⅜-in. O.D., 1-in. I.D. tubing, threaded on one end to receive the core barrel, and the other end threaded to receive the rod coupling. New core barrels are now being made from 1⅜-in. O.D. and 1-in. I.D. tubing—one end to take the bit and the other to take the rod coupling.

DRILL RODS are made up in lengths of 12, 14, 24, 36, 60, 84, and 108 in. These lengths were standardized to suit the effective runs of the drill machines. The 14-in. rod is used with the Longyear machines, which have a 20-in.



BACK STOPING follows the completion of breasting after the stope-drift timbering has been erected and the stope filled with waste. The drilling operation is illustrated in the upper right of the longitudinal section, which is taken through the center of the stope drift. The cross-sectional view is taken through the chute.

feed, because, to change rods for a new run, only a 14-in. rod can be added, after deducting the length of the coupling.

Best Speed 1,200 r.p.m.

ROTATIONAL SPEED of 1,200 r.p.m. was found to be most efficient. During the experimental period, test drilling was done to determine the best characteristic to be incorporated in a drill which was to be designed for the Soudan formations. It was determined that a rotational speed of 1,200 r.p.m. was the most efficient for drilling the ore. Speeds of 7,200 and 3,600 were also tried and found to be entirely too fast, as the diamonds received a high polish in a few seconds of drilling time and then the bit would cut no more. The Sullivan HS-4 machines, with their slow speeds of 1,800 r.p.m., are being used today, but the HS-10 machines coming after the HS-4 have speeds of 1,200 r.p.m.

HYDRAULIC PRESSURE at the machine is maintained at 190 p.s.i.

The Sullivan machines have a hydraulic piston area of 14 sq.in. With a control valve incorporated in the machine mechanism, a hydraulic cylinder pressure is controlled to operate at 150 lb., more or less, as shown on the hydraulic cylinder gage. This pressure, theoretically, would generate a force upon the bit of 2,100 lb., but deducting 10 percent for friction, will bring the force down to 1,790 lb. The area of the cutting face of the bit averages about 1 sq.in., depending on the amount of wear the bit has experienced, and the force of 1,790 lb. resolves into an average of 1,790 p.s.i. on the bit. It has been found, by experiment, that the best pressure to apply on the bit for the average Soudan ore is 1,700 lb. In operation, the pressure, as shown on the machine gage, is controlled by the drill runner to the best advantage.

The Longyear machine, with its twin hydraulic cylinders, has a total effective piston area of 8 sq.in. The drill machines are equipped with a pressure control valve and are manipulated, as are the Sullivan machines, to produce a pressure on the bit which will be the most advantageous.

The Bit Water

BIT WATER, on both Sullivan and Longyear drill machines, is supplied from the same source as is the hydraulic cylinders. A con-

Drilling Speed With Electric Drills and Inches per Bit, in Ore. October, 1944

Machine Number	In./Minutes	In./Bit
1	0.9951	59.71
2	1.0191	77.21
3	0.9083	46.16
4	1.0698	58.29
5	0.9744	65.92
6	0.9394	64.13
7	0.9059	71.32
8	1.0822	61.30
9	1.1895	61.78
Average for all machines, October, 1944	0.9990	61.31
Average for season 1944	0.9514	49.92
Average for year 1943	0.8825	42.17
Average for year 1942	0.8434	26.16
Average for year 1941	0.9649	24.76

trol valve on the machines regulates the amount of water to the bit. The average Soudan ore requires 2 to 3 gal. of bit water per minute.

DRILLING RATE. Speed of drilling, expressed in inches per minute, is based on over-all drilling time, which includes: changing position of drill on post and arm, changing bits, changing rods, and removing core. The over-all or "elapsed" time is about two times the actual drilling time.

No records have been kept which show the best drilling rate experienced, because, due to changing ground conditions, it is possible to experience the highest and lowest drilling rate in one and the same run of an individual bit. For this reason all comparisons are based on averages over a given period of time. It is a fact, learned from observation, that the rate of drilling is determined by the hardness of the ore.

BITS ARE BETTER today. It is known from experience that penetration per bit-use depends upon the quality of the bit and the condition of the ground. The bits in use today are, on the average, better than those used during the first three years of Soudan drilling experience. The bits used during October last, all being average, show a penetration varying from 46 to 77 in. per bit use, which variable penetration points to variable ground conditions.

The record shows an average increase of penetration from 24.76 in./bit in 1941 to 49.92 in./bit in 1944. This improvement in penetration is attributed to improvements in bit design. Changes in design of bits have been many. At first, the bits had only two water ways, and enough bit water was not allowed to pass to assure proper washing out of cuttings. Four water ways were tried, and finally six water ways were adopted and are standard today. The first bits were thin-walled and were structurally weak. The present bits are thick-walled and stand up well.

Records Kept Carefully

BIT PERFORMANCE is carefully recorded. A complete record of each bit is kept, showing: when it was received; when it went into service; what driller used it; the stopes in which it was used; the amount of drilling it did in ore, jasper, and rock; when it was removed from service; and how many times it was reconditioned.

Without a record no logical order of improvements could be made. Through the records, any change of bit design can be detected whether an improvement was accomplished or otherwise.

From the same record of bit performance, data on drilling practice are also obtained and used for improvements in drilling. These records show: what *two drillers* can accomplish on the same machine in the same working place; what *two* machines can do, both operated by the same runner in the same working place. Any deviation from the expected results is readily checked for errors, and the necessary corrections are made. Difficulties can be of such nature as: faulty machine; faulty water pressures; faulty reconditioned bits; or possible faulty manipulation of the machine by the drill runner.

Care in Bit Handling

BIT HANDLING is done with care. Each driller has a box, or case, having a place for 20 bits and containing 15 on the average. Each box is numbered and has, on the outside, two metal tags, one with the driller's number stamped upon it, and the other with the working place. The driller finds his box at the station and takes it to his working place. When his bits are dull, he replaces them in the box, and returns them to the shaft at the shift end. The cage tenders take all these boxes of dull bits found at the shaft to surface, where they go to the bit shop for reconditioning. Sometimes the driller can use his box of bits several shifts before sending them to the shop. Once in a great while they must be sent up during the shift.

Each bit is supplied with a small piece of paper upon which the driller will mark the number of inches the bit drilled in ore, jasper, and rock. When the bits reach the shop, the record from the piece of paper is transferred to a book, in which is a prepared sheet for each and every box. This book is brought up to date at the end of the month, and new sheets are made, one for each box, each sheet containing a list of the bits in that box. These sheets become a permanent record of the performance of both bit and driller.

The driller is responsible for his box of bits, in so far as a record of them is kept, these being checked and accounted for many times during the month. It is gratifying to note that no bits have been lost since this method of bit recording was adopted in February 1943.

RECONDITIONING of the core bits is done on surface in the drill shop, where a Pangborn type "EQ-3" blast cleaning cabinet is used. Within this the bit is mounted upon an air-driven rotating jig, developed by J. D. Warner (Patent

Advantages of Electric Diamond Core Drilling of Blast Holes at Oliver Iron Mining Co.'s Soudan Mine

COST REDUCTION. Cost per foot of drilling has been substantially reduced since this method came into prominence, even though the cost of labor and supplies has risen in the last three years. The betterment of core drilling over pneumatic drilling in this respect is approximately 35 percent.

GREATER DRILLING SPEED. The electric drills are nearly twice as fast as the pneumatic drills in the average drilling of ore. As compared with the average of 0.5139 in. per minute for the year 1940 when the pneumatic machines were used, an average speed of 0.9990 in. per minute (based on over-all elapsed time and not on rate of penetration) was obtained for all electric machines in October, 1944, and an average of 0.9514 in. per minute for the entire 1944 season. Further the corresponding averages for 1943, 1942, and 1941 were 0.8825 in., 0.8434 in., and 0.9649 in. respectively.

A factor which helps to increase the drilling rate is that the electric drills are able to drill longer holes (about 20 ft. from one set-up) whereas the pneumatic machines could drill only 7- to 9-ft. holes. Thus more pneumatic-machine set-ups were required for the same amount of drilling than when electric drills were used.

NOISE REDUCTION. That the elimination of noise in industry increases a workman's efficiency is generally recognized. All will agree that the noise of even a single percussion-type air drill operating in a confined working place, such as a mine stope, is not desirable.

DUST REDUCTION. Drilling with any rotary diamond bit, where much bit water is used by necessity, does not produce the quantity of dust injurious to the workman. The Oliver company's ventilation department reports that the dust count of the air in the vicinity of an operating electric core drill is exceedingly low and offers no problem in ventilation.

IN SHORT. Electric core drilling of blast holes offers the Oliver company in its Soudan mine an economical drilling method and an agreeable, healthful working condition for its employees.

2359177), so adjusted that the cutting face of the bit rotates under a sandblast jet at any desired speed. The bits are subjected to the blast of silicon carbide under an air pressure of 38 p.s.i. for ½ to 3 min., depending on the condition of the individual bit.

AN AVERAGE BIT LIFE of 92.66 ft. was obtained during the first ten months of 1944 with 428 bits, which were worn out after drilling 39,658 lineal feet.

It must be remembered that during the life of the bit, some drilling may have been in jasper and rock. During the ten months corresponding to the period in which the 428 bits were removed from service, the production drilling reports show that 96.44 percent was done in ore, 2.17 percent in jasper, and 1.39 percent in rock.

The range of footage obtained with these 428 bits is from a low of 33.2 ft. to a high of 208.25 ft. Much jasper drilling reduces the life of a bit, and much rock drilling increases its life footage. The worn-out bits removed from service during October 1944 showed an average life footage of 100 lineal feet. It is reasonably expected that with the new technique of bit manufacturing, bit life will be greatly increased.

Some Major Problems

DIFFICULTIES experienced in the four and a half years of diamond core drilling in production have been various. The major problem has been to increase the life of the core bits, which has gone a long way from an average of 65 ft. to the 92 ft. shown for this year's average. The bits have been changed from a "thin-wall" to a "thick-walled" bit, adding strength and bit life. The manufacturer has improved his control of fabrication to improve uniformity.

Mine water, recaptured, was, at first, used for drilling and gave trouble in drill operation. A clear-water system was, therefore installed, bringing clean filtered water from the surface.

Electric motor burn-outs, due to moisture, were greatly reduced by providing inspection drains on the motor housings of the drills.

High maintenance of drill rods and core barrels was reduced by changing the design to that already explained, thus eliminating the number of parts in the string.

Sandblasting was at first done by hand, and an uneven cutting face on the bit was the result, which reduced the drilling footage obtained per bit use. This operation was simplified by installing the rotating jig, which also gave a better reconditioned bit and increased footage per use.

LOOKING AHEAD. For further improvement in the art of electric core drilling at the Soudan mine, a special repair, testing, and demonstration room is nearing completion in the company's machine shop building. The room is large, light, and airy. It will be equipped to test the drills under actual drilling conditions, where electric power and water can be measured. A drilling stand will have a machine mounting upon the same frame which supports a specimen bed. Upon the bed will be placed a chunk of Soudan ore, rock, or jasper to be drilled and tested.

The room has a seating capacity for 20 people. It is planned that demonstrations of drilling technique and machine operation will be given from time to time to the drill runners. This idea is in line with the valuable plan of "training Within Industry," as has been developed and practiced in the nation's industries during these past two and a half years.

Why Bunker Hill Believes In Training Supervisors

C. E. SCHWAB, Training Coordinator, Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho

IF THE MINING INDUSTRY wishes to prevent the decline of many of its supervisors into a status little above that of the timekeeper, it must equip its shift bosses and foremen with the knowledge and abilities needed to handle present-day labor problems. The fact was recognized some time ago out at Bunker Hill & Sullivan Mining & Concentrating Co., when late in March 1945 a program of supervisor training was instituted.

Only well started at present, this training program takes supervisors from the Bunker Hill mine, the mill, the smelter, and the Sullivan electrolytic zinc plant, and puts them through three separate courses of instruction and discussions, each one consisting of five two-hour sessions. The first, Job Relations, deals with the ways and means of handling men. The second, Job Instruction, helps the foremen develop better methods of training or improving the men under him. The third, Job Methods, is aimed at turning up better ways of doing the jobs for which the supervisor is responsible.

At Bunker Hill, the Job Relations course was completed in June 1945, and the Job Instruction sessions are now meeting. Job Methods will follow, and a subsequent follow-through program has been scheduled, which, with the three series of meetings, will probably occupy eighteen months to two years in all. The course is given to all shift bosses and to anyone in the departments mentioned who has jurisdiction or supervision over anyone else. About 160 men have completed the Job Relations series and are carrying on the Job Instruction meetings.

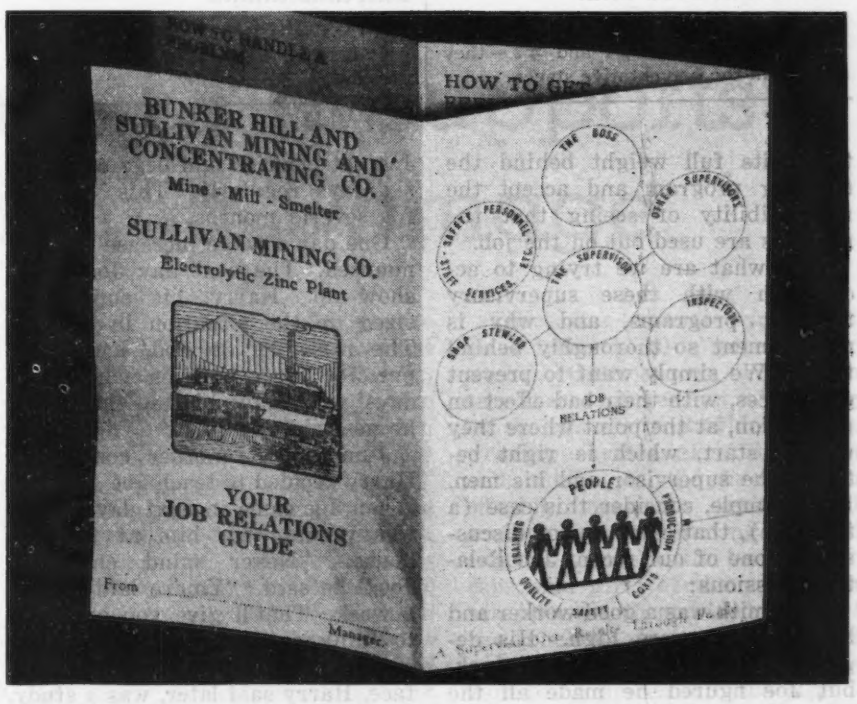
The Bunker Hill training program was built with the help of the War Manpower Commission's Training Within Industry plan. Trainers, selected by the company management, attended a 40-hour Training Institute course to become skilled in handling the two-hour sessions of the Supervisors' Training Course. They were then given charge of the sessions, but in running them they follow manuals prepared by T.W.I. men.

Ideas Are Practical

Many thousands of supervisors have worked on preparation of these T.W.I. Programs, and the results are evident in the logical, common-sense approach the program uses. The ideas, as well as the men, for the T.W.I. have been supplied by industry and industrial supervisors.

Before the trainers begin work with the supervisors, however, they give the course, in its entirety, to the top management groups from mine and plants. Meeting in the evening, the general manager, the general superintendents, the superintendents, and their assistants, all take the same ten-hour program later to be given their men. Then when the supervisors' turn comes, one member of top management opens the session by telling the supervisors that management has taken the same course they are about to take, knows just what they are going to cover, and is particularly anxious that they use what they learn on their jobs.

As a trainer, I have observed the supervisor group closely, and I know that the effect of opening the meeting in this way is tremendous. The fact that management has taken it too and approves it heartily adds an immeasurable amount of prestige to the program. To be effective, any training program needs more than the mere consent of management. As it has done in our companies, management must



JOB RELATIONS CARD, handed to all supervisors during training course. Folded to pocket size and carried by foremen, it acts as reminder of best methods for handling job problems, may prevent their development into grievances. Contents of card are on next page.

These Suggestions for Supervisors Appear on the Job Relations Card

FOUNDATION FOR GOOD JOB RELATIONS

LET EACH WORKER KNOW HOW HE IS GETTING ALONG.

Figure out what you expect of him.
Point out ways to improve.

GIVE CREDIT WHEN DUE.

Look for extra or unusual performance.
Tell him while it's hot.

TELL PEOPLE IN ADVANCE ABOUT CHANGES THAT WILL AFFECT THEM.

Tell them "why" if possible.
Get them to accept the change.

MAKE BEST USE OF EACH PERSON'S ABILITY.

Look for ability not now being used.
Never stand in a man's way.

PEOPLE MUST BE TREATED AS INDIVIDUALS

HOW PROBLEMS COME UP

1. YOU SENSE A CHANGE IN YOUR DEPARTMENT.

Relationships are strained — there is tension.

2. YOU ANTICIPATE A CHANGE IN YOUR DEPARTMENT

A change is coming up and you want to prepare for it.

3. IT COMES TO YOU.

An individual makes a request.

4. YOU RUN INTO ONE.

It just happened.

Keep your eye on #1 and #2 — they are still in the preventative stages.

HOW TO HANDLE A PROBLEM

GET THE FACTS

Review the record.
Find out what rules and plant customs apply.
Talk with individuals concerned.
Get opinions and feelings.
Be sure you have the whole story.

WEIGH AND DECIDE

Fit the facts together.
Consider their relation to each other.
What possible actions are there?
Check practices and policies.
Consider effect on individual group and production.
Don't jump to conclusions.

TAKE ACTION

Are you going to handle this yourself?
Do you need help in handling?
Should you refer this to your supervisor?
Watch the timing of your action.
Don't pass the buck.

CHECK RESULTS

How soon will you follow up?
How often will you need to check?
Watch for changes in output, attitudes and relationships.
Did your action help production?

HINDRANCES TO UNDERSTANDING MEN

THE DIE CASTING HABIT

Trying to fit individuals to an imaginary pattern which we have set in our minds.

THE JUST LIKE HABIT

Reminds you of some other person you perhaps don't like. Then you compare worst characteristics.

THE GO, NO-GO HABIT

Judge and sentence a man on your first meeting.

THE FORMULA HABIT

Handle all old-timers alike. Handle all chronic kickers alike.

THE STANDARDIZATION HABIT

Expect all people to react alike to situations. Not watching for special interests. Not developing workers' strong points.

FACT GETTING QUESTIONS

What employee does.

Time on present job.

Length of service with company.

Present working environment.

What is his work record on production, quality, attitude, absenteeism, initiative.

What recent changes in job or rate, type of work, relationships, working conditions, hours. Have four foundations for good relations been applied?

Personal data. Age. Marital status. Family. Hobbies. Civic interests. Personality. Temperament. What other persons involved. Any intermediate action taken.

HOW TO GET OPINIONS AND FEELINGS

1. Allow a cool-down period.
2. Encourage individual to talk about what is important to him.
3. Don't interrupt.
4. Don't jump to conclusions.
5. Don't do all the talking yourself.
6. Listen carefully and patiently.
7. Don't argue.
8. Arrange for meeting in quiet place. Put him at ease.
9. Keep on subject—don't allow conversation to wander.

throw its full weight behind the training program and accept the responsibility of seeing that the methods are used out on the job.

Just what are we trying to accomplish with these supervisory training programs, and why is management so thoroughly behind them? We simply want to prevent grievances, with their bad effect on production, at the point where they usually start, which is right between the supervisor and his men. For example, consider this case (a true one), that came up for discussion in one of our recent Job Relations sessions:

Joe Smith was a good worker and his earnings were high. His department was on a six-day week, but Joe figured he made all the money he needed in five days, so he fell into the habit of staying away on Monday. Presently, however, Joe got married and began to work six days regularly. This went on for several months.

One day a wage increase was announced. The next day Joe didn't show up. Harry, his supervisor, sized up the situation in a flash. The raise, he decided, had again put Joe in a position where five days' work gave him all the money he needed.

Jumping to another conclusion, Harry decided to teach Joe a lesson. When Joe came in next day, Harry was waiting for him at the dry house. "Never mind changing, Joe," he said. "You're laid off for a week. That'll give you a chance to think over what's in your pay envelope." Joe said nothing. His face, Harry said later, was a study. Joe turned on his heel and walked out.

A few days later at lunch another supervisor asked Harry why he'd been so rough on Joe. "He rated it, didn't he?" replied Harry.

"I don't think he did. Neither does anyone else in the shop. You see, Joe's father had an automobile accident the morning after the pay raise. He was badly hurt and Joe had to look after him. Joe never had a chance to explain."

That's the old way of handling things, and that's how grievances start. There can be but few members of management who have not been plagued by grievances and union problems. Many of these arise as a direct result of action taken by some shifter or foreman. A loyal, conscientious, old-time boss, thinking he is handling a problem correctly, causes a grievance, and a jam with the union may be the result. The supervisor then gets bawled out for the way

he handled the problem, so, like the burnt child who shuns the fire, he ducks further problems and becomes a buck passer.

The trouble is compounded then if management lets this supervisor bring his problems to the head office for solution. By dodging responsibilities in this way, some shifters are fast losing their grip and some managements are actually, though unwittingly, helping this process along.

What's wrong with this situation?

First, the shifter has not been told, or has made no effort to find out, what his authority is under a union contract. He may have been a shifter for over 20 years and doesn't intend to change his way of handling men just because they now wear union buttons.

Second, having got into hot water by wielding authority, he has decided to shed what he can of it by passing the buck onto the boss.

Third, the boss has committed a cardinal crime in supervisor-management relations by allowing the shift boss to pass the buck successfully.

Here is a good instance of a crying need for supervisors' training; not something to ram down supervisors' throats but some new tools with which they can do a better job. Nothing could be further from the truth than to suppose a job relations program for supervisors will be a cure-all to prevent problems from arising. Problems are going to come up anyway, but the training program will help the supervisor handle them.

Card as Reminder

Take the Job Relations program, for example. The five two-hour sessions are built around the pocket-size folder we give to all the supervisors. This card stresses the four-step method for handling a problem, namely: (1) get the facts, (2) weigh and decide, (3) take action, (4) check the results. Foundations for good jobs relations are pointed out again and again. Meeting in small groups of eight or ten men, each shifter or foreman has ample opportunity to discuss his problems and others that the trainer brings in (such as the Joe Smith case) to illustrate some one phase of the four-step method. No reports are ever made to management on what is said at the meetings, and the men know they can speak freely.

Under the old system the boss stands on his authority, jumps to conclusions, and snaps out orders. The result may well be a big hole in production, a worker burning with a sense of injustice, and the whole department on edge. Under the job relations system the supervisor delays his response, decides first what he wants to accomplish, gets the facts and reviews them. Then when he takes action, the chances are strongly in favor of its being the right one. That's the attitude the Bunker Hill supervisor training program is aimed at developing.

Upon completing the ten-hour course (meetings all held on company time), each supervisor is sent a Job Relations card, certifying his work, and a personal letter from J. B. Haffner, general manager, from which I quote:

"Together with the various superintendents and their assistants I have taken the course myself, so I am thoroughly familiar with the aims and objects of the training. It is not the question of coddling and pampering. It is the question of being fair and considerate; and I cannot but feel that a continued application of these aims and objects will be instrumental in the establishment of harmonious relations all around, which in turn is certain to be reflected in improved operating results. Your wholehearted cooperation will be much appreciated."

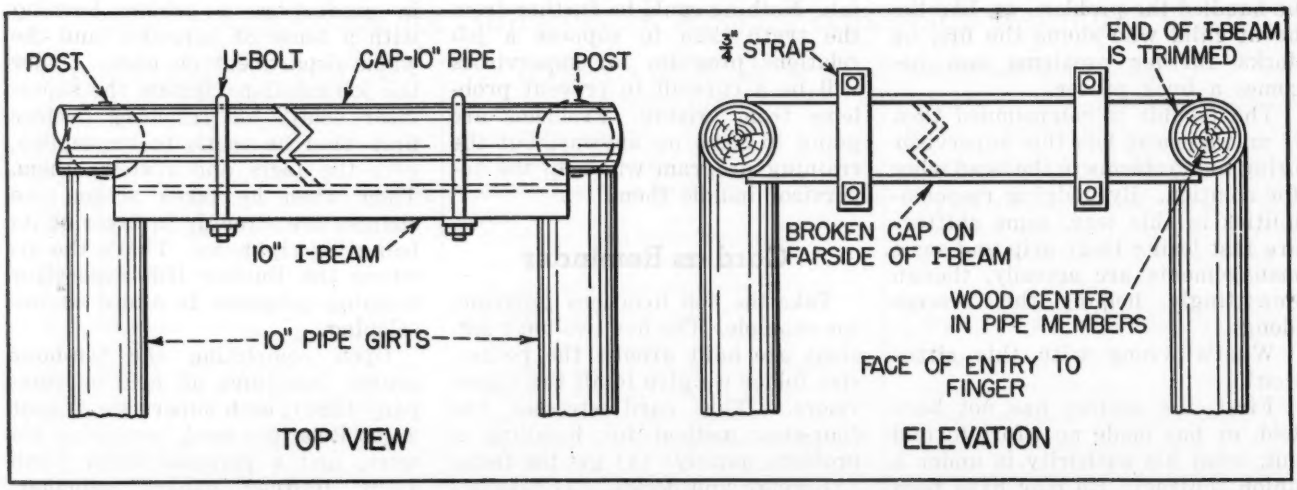
Pipe Scram Drift Supports Resist Blasting Damage

TEN-IN. PIPE MEMBERS tightly encasing turned wooden poles replace conventional timber sets which failed to withstand heavy blasting and scraping in scram drifts at the property of the National Tunnel & Mine Co., Tooele, Utah, where a large copper-bearing orebody is being mined by diamond-drill blast hole methods. See *E.&M.J.*, August, 1945.

The drifts are 8x6 ft. in cross-section and 200 ft. long. Pairs of 4x4-ft. fingers at 15-ft. intervals are driven to the floor of the stope undercut approximately 15 ft. overhead. When stoping was first started, coarse broken material requiring heavy bombing in the fingers caused shattering of pillars and rapid disintegration of the fingers. As a remedy, the drift floors were lined with rails, 10x10-in. wooden sets were installed, the backs were lagged over, and "scrub boards" were mounted along the sides of the drift between fingers to a height of 2 ft. However, these measures proved unsatisfactory because scrapers collided with posts and damaged them, blasting in the fingers knocked out timbers near the finger entries, spalling with gradual disintegration of the fingers increased, and the back of the drift became blocky and dangerous.

Thereafter special square sets made from old 10-in. pipe were installed. Open spaces between the sets were bricked up with large square timbers to provide a smooth wearing surface along the drifts and entries to the fingers, thus offering maximum resistance to scraper wear and blasting, and solid support to the drift back. Posts, caps, and girts of the pipe square sets are cut to specified length in the machine shop, and filled with poles which are turned to size before being driven into the pipe.

Underground, the sets are erected at the finger entries, and the joints spot-welded. Reinforcing angle



PIPE MEMBERS across finger entries are repaired by clamping broken pieces to 10-in. I-beam.

irons connect the joints as shown in the accompanying photograph. As soon as the number of sets have been erected, timber bricking is built up level with the top of the sets. Lagging across the back in the sections between fingers consists of round poles, and that over the steel sets of 90-lb. rails, as most blasting occurs in this area.

As the lower 3 ft. of the pipe posts are exposed to the scraper, bumping and occasional damage to the post is inevitable. Damaged or worn post sections are repaired by welding semicircular pieces of plate cut from 4-ft. sections of 10-in. pipe to the worn sections. To avoid spreading or actual knocking out of the rail lagging above the pipe sets by blasting or by large boulders rolling down the fingers, a length of $\frac{3}{8}$x3-in. angle iron is welded to the cap and the rails are bolted to it.

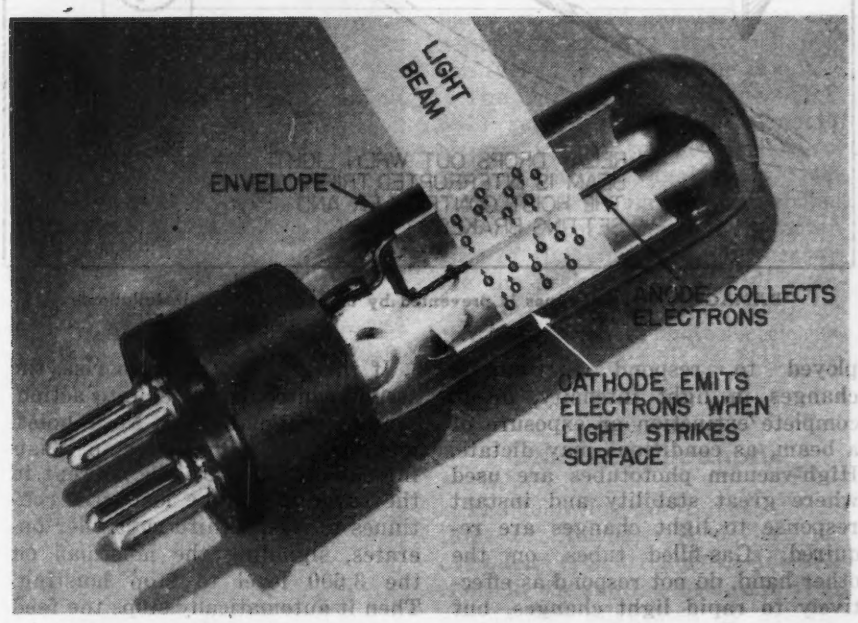
Caps occasionally cracked by the impact of large boulders or improper placing of bombs in the fingers are repaired as illustrated.

Air and water lines are carried overhead through the drift and through the cribbing, with recessed outlets at 30-ft. intervals. Scrapers used in the drifts are Holcombs cut from 54-in. to 42-in. width, with a steel guide around the perimeter made from $\frac{5}{8}$x6-in. material to reduce wear, breakage, and timber abrasion. The scrapers have about 12 in. of rib clearance on either side, which avoids boulder hangups when slushing past open fingers and tends to eliminate side whip of the scraper. This method has been found economical in slusher layouts involving up to 800 ft. of scram drifts. Concrete support should be considered in drifts exceeding that length.

SCRAPER IS HAULED by 30-hp. double- drum I.R. tugger. Six-in. steel band around upper part of scraper reduces wear and timber abrasion.

Rugged Phototube Devices Ready for Use in Mining

Applications of the phototube and its potential uses in the mining industry are discussed in this second article of a series on electronics presented by *E.&M.J.* to encourage a more general and practical acquaintanceship with a branch of electrical science which can serve the industry.



THE PHOTOTUBE is the sensitive element of control relays which respond to light.

CONSIDER THE PHOTOTUBE when planning safe and efficient mining operations. Although this small electron tube generates only a few millionths of an ampere in response to beams of visible or invisible light, it can put the finger on the pulse of various processes, regulating them to conform rigidly to desired performance, and warn and control in event of danger. Despite the fact that electronics engineers caution us not to expect miracles from this equipment, it will do no harm to review current successful applications, and appraise promising potential uses.

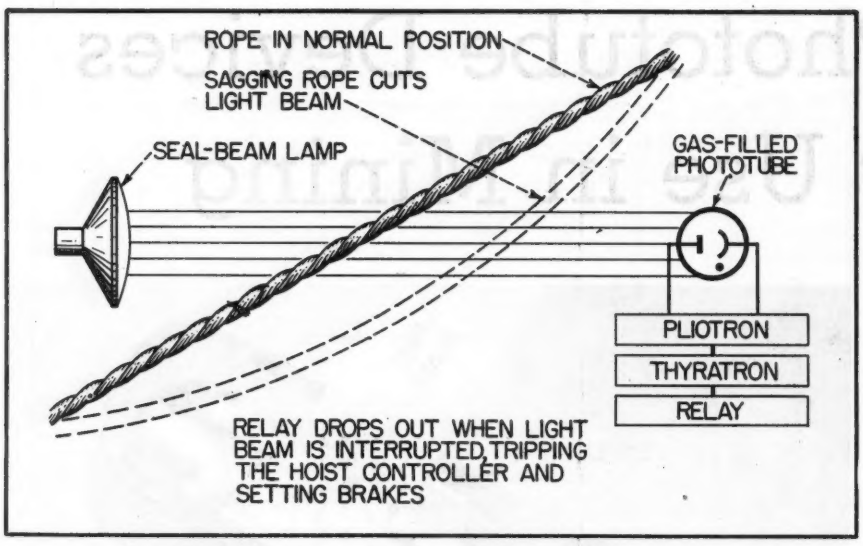
Phototube Relays

Most phototube units built for industrial installations consist of a light source and relay. They are built more ruggedly than is generally realized, and are as dependable and easy to install as a wall switch or service outlet. The relay here illustrated is typical and of special interest because it reviews the functions of tubes in electronic devices. Light entering the window in the cover impinges on the semicylindrical cathode of the phototube, which emits electrons, thereby supplying a few millionths of an ampere to the tube on the right, which amplifies this feeble output sufficiently to operate the gas-filled thyratron in the center. The thyratron acts as a switch and energizes the conventional relay to control currents of 5 to 10 amp. at 115 to 220 volts.

As phototubes are used to operate safety devices, it is important that such equipment be dependable. Phototubes have an expected life of about 25,000 hours, and auxiliary tubes in the relays last several thousand hours. An ordinary headlight bulb, which may be used as a light source, costs only a few cents and has an average life of about 3,000 hours. You can't injure a light beam—and that just about sums up a major advantage which photoelectric installations have over purely mechanical-electric controls.

THESE ARE THE PARTS of a typical photoelectric relay which translate changes in an intangible light beam into instant, positive, electrical and mechanical action.

When an invisible light beam is desired to prevent trespass or detection, an infrared cap is placed over the light source to cut out visible light. Phototubes vary in characteristics, and may be em-



DAMAGE to hoisting ropes is prevented by this photoelectric installation.

ployed to respond to minute changes in light intensity, or to complete extinction or exposure of a beam, as conditions may dictate. High-vacuum phototubes are used where great stability and instant response to light changes are required. Gas-filled tubes, on the other hand, do not respond as effectively to rapid light changes, but are generally used in applications requiring extreme sensitivity. They have a greater output for a given amount of light than vacuum tubes. Having acquainted ourselves with the nature of this equipment, let's see how the industry is using it and weigh a few possible applications.

Peak Load Control

At the Wright-Hargreaves Mines, Ltd., Kirkland Lake, Ontario, power is purchased on the basis of maximum demand during the month, and therefore it is desirable to operate the plant so that power consumption is uniform and as close to the monthly peak as possible.

Three Lincoln duplex demand meters equipped with a means of controlling the peak load registered are mounted on the switchboard. A flag is attached to the pen arm of each meter, and a light source and phototube are mounted behind the scale. As power consumption tends to rise, the pen arm carrying the flag interrupts the light, actuating the phototube, which in turn actuates the control circuit.

Of the three peak controllers, the first controls the power used by the mine pumps, also by the water heaters for the mine dry, and by the 200-kw. preheater in the steam plant.

If the load continues to rise, the second controller comes into action, sending a signal to the No. 3 hoistman, notifying him to stop hoisting. It also cuts off the current in the sawmill. If the load still continues to rise, a third controller operates, signaling the hoistman on the 3,600 level to stop hoisting. Then it automatically stops the feed in the crushing plant, cutting the flow of ore and allowing 20 seconds for the Symons crusher to clear itself before shutting it down. Two large ventilating fans are also stopped, and a 2,400-c.f.m. compressor is unloaded. All this is done in successive steps with a rising load.

If under these conditions the load tends to drop, the entire procedure is reversed, and all equipment is cut back in until desired consumption is again attained. As the mill is on constant load, running three shifts per day, it is allowed to take whatever power is necessary. The object of the installation is to keep the total power consumption during the months as close as possible to the average demand for the mill. As the company has surplus hoisting and crushing capacity, it can control its peak in this manner. Thus pumps and water heaters run during low-peak periods, and a fairly uniform load curve is attained.

Another phototube at Wright-Hargreaves controls the feed coming into the mill. A rising pile of ore interrupts a light beam, which shuts down the feeding conveyor. A third installation controls the temperature of the furnace used for heating bits. The temperature-indicating arm of a recording pyrometer carries a flag which interrupts a light beam at a predetermined setting, thereby cutting out the heating element. Dropping temperatures reverse the action.

A safety device employs the phototube at the No. 3 shaft of this property, where hoisting is done with combination skips and cages, the cages being underslung. Here it is important to limit maximum travel of the cage above the collar when men are being handled. Under normal ore-hoisting conditions the cage is permitted to go some 45 ft. higher than when men are being handled. To protect men under these conditions, a light source and phototube are installed at the hoist as shown in the accompanying photograph. The unit becomes operative when a return signal is given —that is, when men are on the cage. A switch is provided to clear this circuit after men have been handled and normal hoisting is resumed.

Shaft Installations

At the Castile Mining Co., Ramsey, Mich., a phototube unit is installed in the headframe to guard against running the skip into the dump, and another in the shaft to indicate when cages have been landed on chairs.

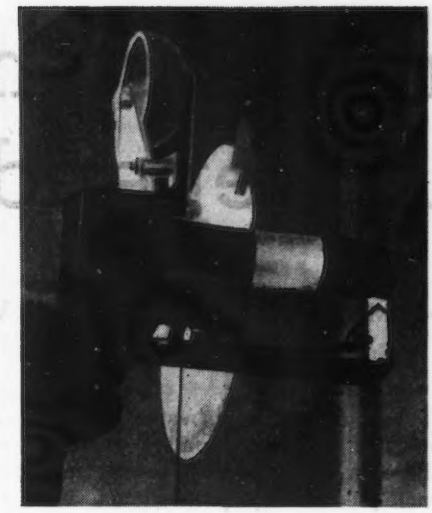
At the Mather mine of the Cleveland-Cliffs Iron Co. a skip must intercept a beam of light directed on a phototube upon entering the ore pocket on the 1750 level before the skip tender can open the gate of the measuring pocket.

Several companies have reported that phototube installations are unsatisfactory in upcast shafts where occasional formation of fog interferes with performance. In discussing this problem with electronics engineers, we find that a new industrial phototube unit has been perfected which uses a modulated light beam produced by a motor-driven interrupter. This beam causes the phototube to generate an alternating type of current which can be amplified more readily than that produced by an unmodulated beam, and satisfactorily overcomes the effects of fog and rain in the light path. In fact, one test showed that when a sheet of paper was placed across a 1,000-ft. light path separating the source from the tube, the equipment continued to function as desired. This installation is considerably more expensive than other types. However, in the interest of safety it may be beneficial under some circumstances.

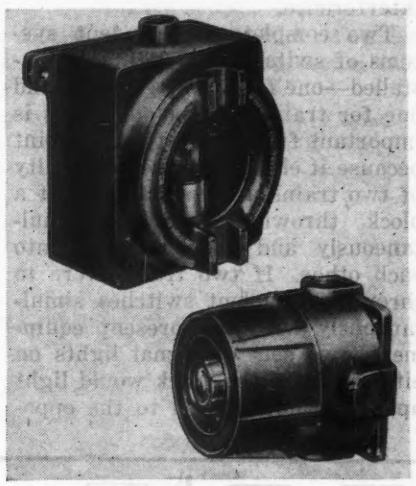
Electronic fences which sound an alarm when a trespasser intercepts a beam of invisible infrared light are common for anti-sabotage protection. One gold-mining company in Ontario reports that an electric eye is used to guard a powder magazine.

If fire breaks out in the basement of the mine warehouse of the Castile Mining Co., smoke will cause a photoelectric relay to sound an alarm and a siren. An industrial smoke detector and photoswitch is illustrated. One electrical engineer suggests that such an installation would be ideal in substations both underground and on the surface, to operate protective control devices which would function the instant smoke is formed by overheated windings as is common in case of sustained overload or machine faults.

When mine hoists are operated in balance, one of the skips may hang up in the dump, resulting in the accumulation of slack rope in the drum pit and in irreparable damage to the rope if the operator does not notice the condition in time. Generally the unbalanced rope load will be indicated on the hoistman's ammeter, but this will be valueless if he happens to be looking elsewhere at the instant. The photoelectric device here illustrated has been installed with good results at several mines. A minimum of three foot-candles is sufficient to operate the electronic circuit, which contains a potentiometer so adjusted that a 40 percent drop in the three foot-candle range will cause the relay to drop out.



THE FLAG on the disk intercepts the light beam, which prevents the hoistman from raising a cage containing men above the top station of the shaft at the Wright-Hargreaves mine.



THIS TYPE of smoke detector could be used to close mine ventilation doors in case of mine fires. Suitable relays and mechanical levers could be installed to operate the air doors.

Mercury Vapor Detector

Because droplets of mercury scattered on the floor can produce toxic concentrations in the atmosphere under certain conditions, mercury plants must adopt measures to prevent mercury poisoning. One industrial vapor detector, sensitive to one part of mercury in 200,000,000 parts of air, draws samples of air through a chamber containing an ultraviolet lamp and a phototube. Minute concentrations of mercury cause optical interferences, whereupon the voltage output of the phototube alters and operates a calibrated indicating instrument, or relays which energize alarms.

When quantitative assays of ore are performed by burning a sample in a d.c. arc and photographing the spectral lines emitted, a photoelectric densitometer may be used to measure the relative intensity of these lines on the negative, thereby determining the concentrations of elements present. Densitometers also record values for a succession of lines on a continuous chart.

Photoelectric Pyrometer

The photoelectric pyrometer which will be of interest to pyrometallurgists employs a vacuum-type phototube with a caesium-oxygen-silver cathode which is stable in its sensitivity and is not appreciably affected by voltage variations. Radiant energy which emanates from a hot body causes the tube to release a flow of electrons which bears a definite relation to the temperature of the hot body. This minute current is then amplified by a pentode to operate temperature indicators. A thyratron may be used in conjunction with the amplifier circuit to operate control equipment.

Other photoelectric equipment keeps a watchful eye on the pilot flame of oil and gas furnaces and refuses to open valves which feed the fuel if the pilot flame is out.

The U. S. Bureau of Mines (T.P. 661) reports the use of a photoelectric temperature controller for making thermal analysis of clay minerals. Each clay has transitions at temperatures that are characteristic of that material. By measuring the peak temperature differential between the clay and the container with a photoelectric potentiometer, the type of clay mixture can be identified.

Other Applications

The following additional applications of photoelectric devices are compiled from reported installations in the mining field, and from adaptations suggested by descriptions of industrial equipment:

Liquid level indicators.

Plant floodlighting control.

Smoke-density indicators, recorders, and control relays.

Turbidity measurement and control. One device is capable of differentiating between 16 and 17 parts of solid matter in 1,000,000 parts of water.

Warning devices which shine a light in a truck driver's eye to notify him that equipment is approaching the truck road.

Door openers for underground ventilation passages, and types on the surface which will respond to a flash of the headlight to permit trucks to enter inclosed loading and weighing stations.

Relays which open gates over inclosed hoppers when a truck pulls into dumping position.

Colorimeters for chemical analysis. A spectrophotometer sensitive to 2,000,000 different colors is used to determine concentrations of zirconium, zinc, copper, molybdenum, and vanadium.

E.&M.J. gratefully acknowledges the assistance of mine operators and technicians who have contributed information generously for the preparation of this article, and to numerous industrial, electrical, and application engineers who have assisted in this presentation.

Block Signal System Is Safe and Dependable

L. D. STEWART, Electrical Engineer, Montreal Mining Co., Montreal, Wis.

THE BLOCK SIGNAL SYSTEM in use at the Montreal mine requires a minimum of wiring, is positive in action, and possibly more free from trouble than many systems. It is employed to regulate traffic safely on a main haulage level (see diagram) consisting of a long double-track, shaft-crosscut running out to a single-track haulage drift extending both ways from the end of the crosscut. Several parallel, single-track, loading crosscuts branch into the formation. From three to five trains operate over these tracks, and any train may serve any loading point.

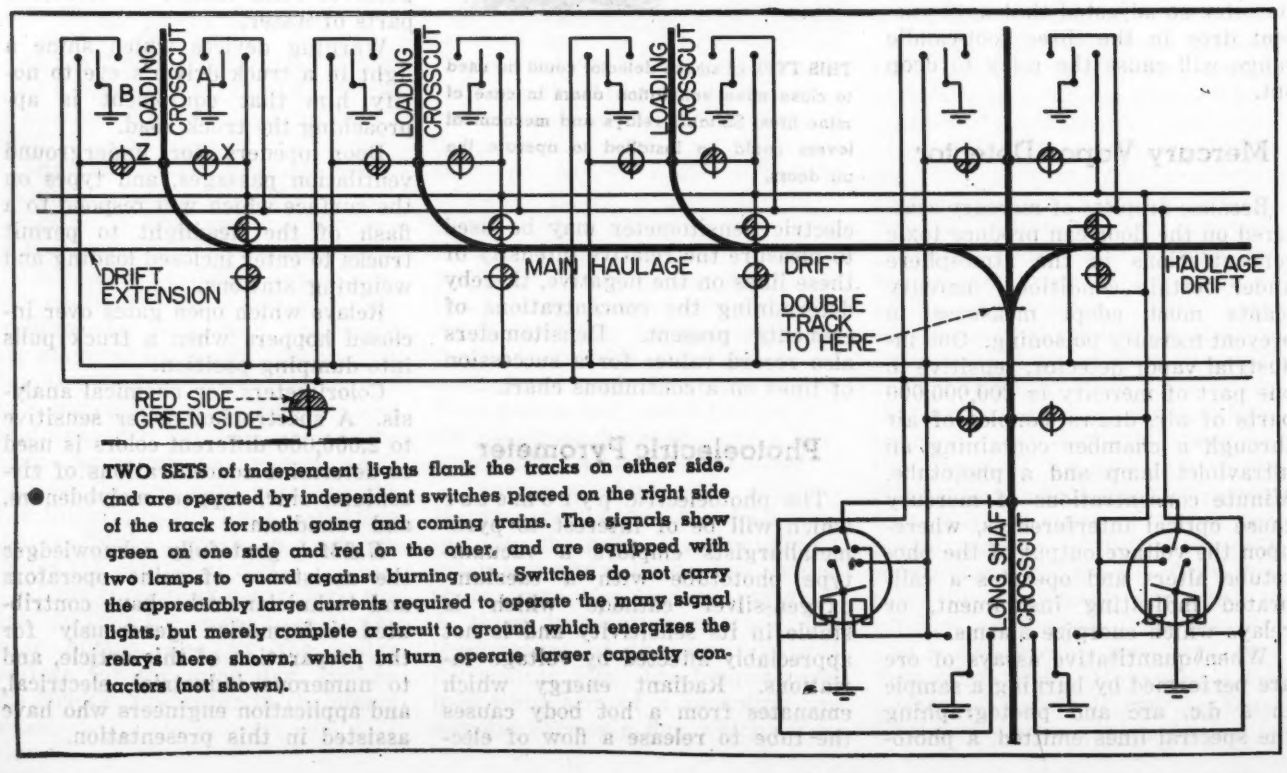
Hence it is necessary to block the single-track main haulage drift and to clear it at any of the loading crosscuts regardless of which way the train might be going. It is also necessary to block the single track at the end of the shaft crosscut and the extensions of the drift beyond the loading crosscuts.

Only two contacts carry current operating the signals. Because there are no series connections, each piece of equipment, such as a switch, is independent of all others. Thus if one switch fails, the rest of the system will still function properly. As all equipment is in parallel, it is easy to expand or abandon it at any point without interference.

Two complete independent systems of switches and lights are installed—one for trains going in and one for trains coming out. This is important from a safety standpoint because it eliminates the possibility of two trains at opposite ends of a block throwing switches simultaneously and then running into each other. If two trains were to throw independent switches simultaneously with the present equipment, two sets of signal lights on either side of the track would light up, each showing red to the opposite train, thereby demanding that one of the trains clear the block.

Switches, such as the one here illustrated, are placed on the right side of the track for going as well as coming trains. They are normally open, and are in contact only at the time the trainman operates them in passing. Each signal shows green on the near side and red on the far side, and is equipped with two lights to guard against burning out.

When a trainman enters the block beyond the double track, and if the block is clear, the trainman throws a switch in the direction in which the train is traveling. This gives him a green light and exposes a red light in the opposite direction. Throwing the switch momentarily causes it to operate a relay which completes the lighting circuit and carries all the current. After going through the block, the trainman clears the block by oper-



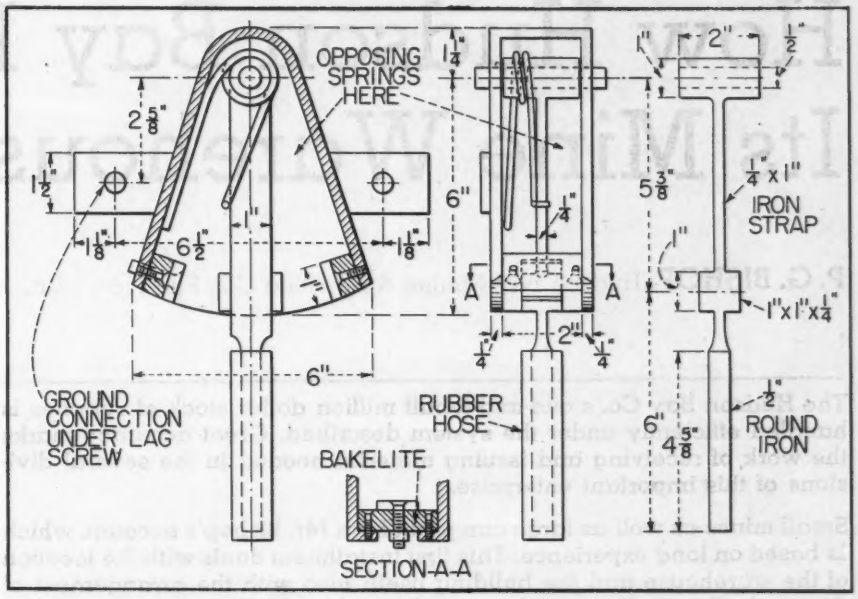
TWO SETS of independent lights flank the tracks on either side, and are operated by independent switches placed on the right side of the track for both going and coming trains. The signals show green on one side and red on the other, and are equipped with two lamps to guard against burning out. Switches do not carry the appreciably large currents required to operate the many signal lights, but merely complete a circuit to ground which energizes the relays here shown, which in turn operate larger capacity contactors (not shown).

ating another switch in a similar manner.

By way of further illustration, suppose a train enters the left loading crosscut. The trainman would throw switch *A*, which would light signal *X* and all other signals on the same side of the track for trains going in. Lights on the other side of the track, *Z*, would remain dark, being governed only by switch *B*. A train coming out of the left crosscut would throw switch *B*, which would energize the light circuit on the other side of the track (right for trains coming out), giving the trainman a green light and showing a red light in the other direction all through the block out to the double track. Upon reaching the double track, the trainman would clear the block.

Switches are home made, of the butt-contact type, and are normally open as shown. Each switch is grounded, the ground closing the circuit to operate the relay, which in turn operates a contactor (not shown) added to carry the large number of lights in the installation.

The relay is of the lock-in type which can be obtained from a number of manufacturers. In this case, a C-H type, No. 525, size "E" contactor, 250 v., 2 normally open, 2 normally closed, relay is used because it is flexible and lends itself to other operations as well.



HOME-MADE SWITCH which is normally open operates the signal system. When the switch is thrown one way, the closed contacts operate a relay lighting the green signals. When thrown in the opposite direction, the switch operates the red signals. Rubber hose on the handles protects the equipment against careless operation by motormen who throw the switches momentarily when entering or leaving a block.

Calumet & Hecla Recovers Scrap Copper

ON ECONOMIC and patriotic grounds, the secondary-metals recovery program which Calumet & Hecla Consolidated Copper Co. expanded last year into a major project has justified itself, company officials report. The present sizable output, affording work to more than 100 employees, was reached about six months ago.

At the peak of its secondary-metals operations Calumet & Hecla had in its yards 30 acres of scrap—half of it from the armed forces—which it was reconverting at the greatest possible speed into usable material.

One great advantage which C.&H. possessed, and of which the Government availed itself, was the ammonia leaching process. Some copper was received in a form pure enough to be smelted directly. But copper containing such impurities as lead, iron, or zinc had to be leached, either instead of being smelted or after being smelted.

The leaching tanks, each of which can hold 700 tons of telephone-line wire, or 1,000 tons of gilding-metal clad steel-bullet jacket stock, played no small part.

The first emergency call came soon after Pearl Harbor. The Navy and the Merchant Marine were in need of copper oxide for ship-bottom paint. The Tamarack leaching plant went to work at once. When Tamarack tailings ran out, the company was forced to buy secondary copper to make the oxide.

The officials decided to go into the secondary-copper business on a considerable scale. Ten years before, at the instance of President (then smelter superintendent) E. R. Lovell, the company had investigated the possibility of such a program. Two obstacles had intervened: metallurgical difficulties and the complexity of the purchasing problem.

Both have since been largely whipped. The first was overcome by the skill of the five metallurgical engineers and technicians in the secondary-metals department, under direction of H. C. Kenny, smelter superintendent. Purchasing became easier after the company appointed an experienced field representative to find the diverse types of salvageable material.

Included in the scrap which C.&H. has been treating are: copper pipe from the U.S.S. "Pennsylvania," sunk at Pearl Harbor; copper, brass, and bronze turnings and shavings from munitions plants; small automobile, refrigerator, and vacuum-cleaner motors; generators and transformers; busbars; and, above all, cable of many kinds. Both the metal "armor" and the Vinylite plastic are salvaged from Navy cable.

Leaching permits recovery of both iron (or steel) and copper from small motors. In other processes only one of the metals can be reclaimed. Precious metals insoluble in the leaching solution can also be separated from copper and brass.

In spite of the advantages which the leaching process gives to Calumet & Hecla, officials point out that unduly optimistic forecasts are not warranted. Competitors are numerous. Even so, officials conclude, the program can keep going and may expand.

How Hudson Bay Runs Its Mine Warehouse

P. G. BISHOP, Hudson Bay Mining & Smelting Co., Flin Flon, Man.

The Hudson Bay Co.'s one-and-a-half million dollar stock of supplies is handled efficiently under the system described. Great accuracy marks the work of receiving and issuing material needed in the several divisions of this important enterprise.

Small mines as well as large can profit from Mr. Bishop's account, which is based on long experience. This first installment deals with the location of the warehouse and the building itself; also with the arrangement of the stock. Succeeding articles will deal with ordering and purchasing, receiving, issuing, and accounting.

STOREKEEPING or warehousing of supplies for mines, though a necessary part of the general operation, often receives less than the proper share of attention and appreciation from management. Operating units get most of the consideration, and the warehouse is expected to have what is wanted and when, just as a matter of course.

Suppose a new mine is going into operation after pioneer work has proved up ore to justify a sizable plant. Would it not be better to build dwellings, shops, and so on, first and then proceed with all speed on the main construction? Generally it is done pretty much the other way around. Operators are so anxious to get into operation that supplementary plant units lag behind, and this may actually delay the production in the end, not to mention the difficulty and discomfort caused.

There is also a tendency to construct the first shops, offices, dwellings, and such auxiliary plant structures too small, and in later years tack on additions and enlarge at great expense, the warehouse being near the end of the procession. As mining is one of the most difficult businesses for which to predict the future, most large mine plants have just grown, like Topsy.

We now come to the main purpose of this article—an attempt to outline a warehouse system. The Hudson Bay Mining & Smelting Co., Ltd., carries supplies costing around $1,500,000 and receives and issues material amounting to roughly one quarter of a million dollars each month. The warehouse and "track scale" employ 17 persons, five of whom do strictly office work. Inasmuch as at least two are always away, on vacation or for other reasons, the average working crew is 15. The surface labor gang is called on for unloading cars or any unusually heavy task.

What Size Stocks?

A big factor in determining the size of an inventory is the distance of the plant from the principal supply market. Generally speaking, the quantity of supplies varies with the time needed to get delivery. The closer you are to a market, or the quicker you can expect delivery, the smaller your stock may be. Thus, if you can obtain delivery in two weeks on any given item, six weeks' supply at the plant is a safe stock. Longer delivery time means larger stocks. Usually stock on hand which will last three times as long as it takes to get replacements is a fair minimum stock. This principle is, of course, subject to several exceptions.

Greater stocks may be advantageous if cheaper prices are obtained for quantity orders, and also if considerable freight saving can be had on carlots of such items as nails, pipe, or other commodity. Consider that it costs about one dollar for stationery and accounting work to carry a single order to the point where the material is placed in stock and paid for. Too many very small orders for cheap items which are constantly used should be avoided. Pool cars of material may be assembled in cities—that is, several shippers may load in one car at some central point. There is some freight to be saved by pooled shipping, but also some disadvantage caused by delay. Unless good judgment is used in selecting items to be so combined, it is a poor plan.

A System That Works

The outline of warehouse work which follows is generally the same as now used by the Hudson Bay company, but seems quite adaptable to a larger or smaller mine or other industry than mining. The system is an adaptation and collection from a number of others. It is not thought to be perfect and is so contrived that any good idea which comes along may be incorporated. In this discussion the following headings will be used in order—location, building, stock arrangement, ordering and purchasing, receiving, issues, accounting, and miscellaneous data.

LOCATION of the main warehouse and material yards is important. It should be carefully selected in advance on a new construction. No doubt it would pay to move or rebuild warehouses which have been poorly located in relation to other plant units. The ideal warehouse location is near the center of the most active operating units. The machine, boiler, and electric shops are likely to be in one building or in adjoining buildings, and will draw material more frequently than other parts of the plant. Therefore, the warehouse ought to be close to the shops, and the distances to the mine, mill, and smelter should be about the same in length, although farther away than

the shops. A few extra steps to get to the warehouse will run into many miles in a few years, amounting to wasted effort and money lost. Most employees love to go to the warehouse; it is a famous way to kill time. Here is a good place to say that low-paid men should draw material. There is seldom any need to send high-priced mechanics or operators to the warehouse.

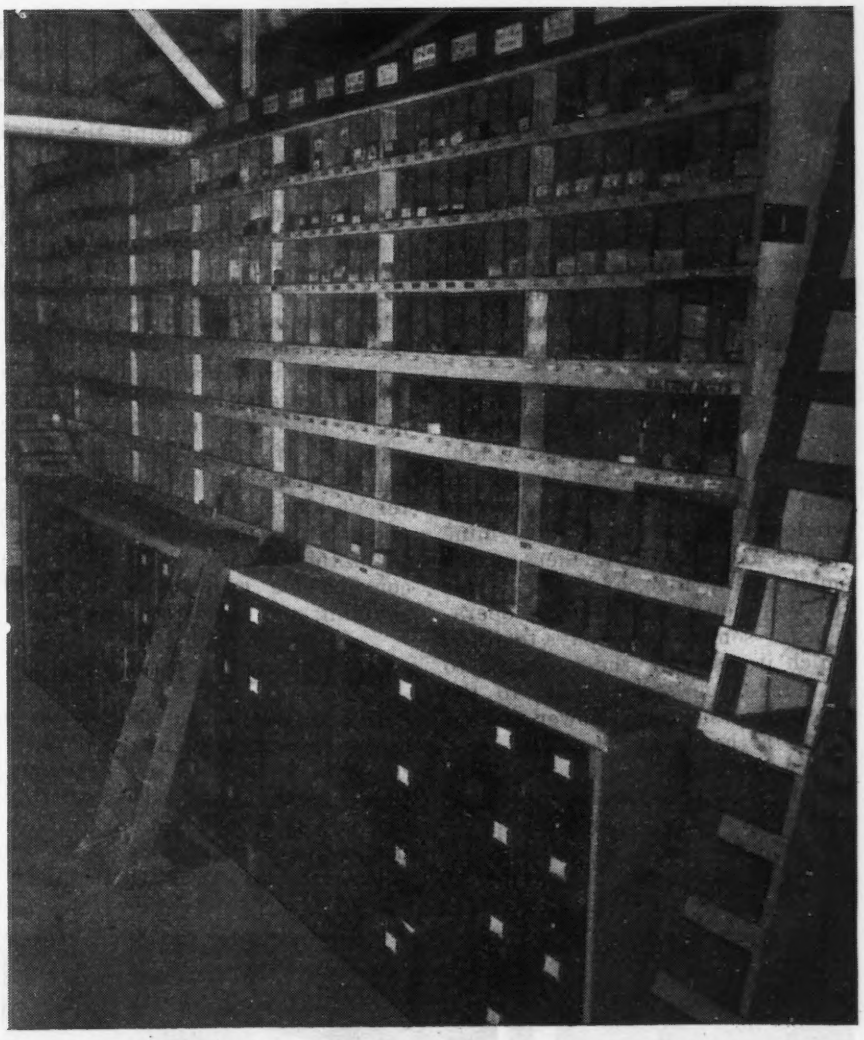
THE BUILDING should be designed for the work. The preferred warehouse is a long, rather narrow structure not more than 100 ft. wide and as long as needed. A substantial platform, about 20 ft. wide, is placed down one of the long sides and railroad track running along this platform. Doors of auto-truck width are desirable about every 100 ft. down the platform and it is well to have a few doors of the same width exactly opposite on the far side of the building. The platform on the track side should be box-car-floor height and the opposite side of the building on ground or wagon-road height. This assumes that the building is on a gentle slope or that sufficient excavation, or other means, would be used to obtain the result just mentioned. This arrangement permits trucks to go through the building and load directly from cars and also shortens the distance freight is moved, either in or out of the warehouse, which is quite an item where heavy material is involved. A portable crane to handle heavy pieces is very useful.

The building shell may be of any material suitable to the climate so long as the walls are rugged, the latter because shelving and stock will go against the walls in places. Plenty of windows, about 4x10 ft., are needed. Most warehouses are poorly lighted. The interior, especially the roof, should be painted light gray to increase visibility.

Inside the Building

Interior arrangement and storage accommodation are better determined after the outer building is completed. The office is preferably located near the door from which supplies are issued, and is fitted with glass walls or windows so that a large part of the warehouse interior is visible from the office. The main receiving door is best placed halfway down the length of the building with a small office for the receiving clerk near this door. A large bare space, up to 60 ft. square, is needed in front of the receiving door and in plain view of the receiving clerk's office, for checking and dispatching material. A weighing scale of about 2 tons' capacity and having a 6x12-ft. platform is needed near the main receiving door, this scale to be built in level with the floor and frequently tested for accuracy.

Then there is the problem of shelving. The style of shelves used depends on the industry served, and there is no very good way of planning shelving in advance. If your building is considerably larger than anybody thinks you need at the start, there will not be much trouble about shelves. Probably the arrangement of shelves will be changed frequently as new lines of material come into stock or for various other reasons. An excellent idea is to purchase a quantity of knocked-down steel shelving which is made up so that most any size or shape of shelf can be bolted together. This type of shelving is on the market and is good-looking, fireproof, and durable, and can be arranged to waste little space.



IN THIS SECTION of the warehouse, a few steps from the main drawing window, are stored cap screws, set screws, stove bolts, and cotter pins, items which are frequently drawn.

Keep Outsiders Out

The door from which supplies will be issued to the operation—that is, the smaller items which are carried away—is best located fairly near the middle of the building, and there should be a hallway leading from the side of the building to the center aisle where a service window and counter is placed. The service counter, about 4x20 ft. long, is behind the service opening and the inner end of the hall and is screened, leaving only the ports open for passing material out of considerable size but too small for a man to crawl through easily. The

idea is to keep outsiders out. For material too large for the service opening, a door leads into the hallway which may be unlocked for use. Scales of various sizes are required near service openings; also measuring rules painted on the counter and floor and any tools or measuring devices which will speed up the issue of material. Telephones and buzzer systems throughout a large warehouse and material yard will save a lot of running around.

ARRANGEMENT OF STOCK in the warehouse must next be considered. It is very important. Light material which is most frequently used should be near the service windows. These items at a mine will be bolts, nuts, washers, nails, small pipe fittings, and tools. After the warehouse has been in operation for some time, it pays to study which items move the most and to transfer such stock closer to the place of issue and slower-moving items farther away.

The entire stock in the main warehouse may be arranged so that nearly all of the various classes of material are in one section and stored in size or number order in the same sequence as these items appear in the stock book. At Flin Flon we have 41 classes of material. This is a valuable feature in placing stock, arranging the stock books, and indexing files, and also in supplying information statements in an intelligent manner. It would be much more difficult to keep straight without this classification. A similar idea could be adapted to any industry. The classification used at Flin Flon is given.

Taking this classification as a guide, material is placed so that nearly all of a given class is in one section. If room permits, some empty space is left between different kinds of items in a section and a larger space between sections for different classes. This will save considerable crowding and avoid shuffling and relocation later on.

Must Lock Up Some Items

In addition to open shelves, three or four rooms which are entirely closed in and locked are desirable. These rooms are also suitably shelved and binned and are for such stuff as hand tools, soap, paint, or other material attractive to pilferers. Certain employees should have keys and be responsible for the contents of these rooms. Items of very high value such as stellite, precious metal, and diamond-drill bits should be stored in the office vault.

Number the Sections

Starting at one end of the building, each section is numbered from Number One forward in consecutive order. Any item in the stock book will show the section number on the stock-book page. In addition to the numbers, signs are also placed showing roughly what is in the section. For instance, Section No. 4 may contain cap screws, set screws, and machine screws. A sign should show these words plainly underneath the section number. Further, under the separate bins or compartments, the exact description of the article should be plainly painted or carded.

When reels or coils of electric wire and cable or steel hoist rope, and the like, of various sizes and types are received, such reels are assigned numbers which are plainly painted on the reels. The reel number is also indicated on the receiving papers and shown in the stock book under the debit entry. There are also manila tags, about 4x6 in., on which are entered the purchase order number and reel number and correct description of contents. These tags are attached to the individual reels, and if the entire reel is issued the tag is sent into the office attached to the issue requisition. If a partial lot is cut off, such issue is subtracted from the quantity shown on the card and the remainder left in stock is written on the tag. If the issue is a partial lot from such reels, the reel number is written on the issue requisition.

All this marking greatly speeds up storing and issuing and increases accuracy. Anything which tends to make warehouse work as automatically and simply as possible helps. The less thinking the crew has to do, the better. Thinking is hard work, and many employees avoid it.

In addition to the main warehouse, one or more supplementary buildings are required for bulky or dirty material or items needing separate storage, such as cement, oxygen, acetylene, or very bulky items not easily placed in the main store. These extra buildings may be of rather rough construction and need not be heated. Surplus and overflow stocks from the main ware-

ITEMS ISSUED SLOWLY, such as machinery spares for cars and locomotives, are stored in these sections approximately 140 ft. from the main drawing window.

How Stock Is Classified at Flin Flon

Class A. Assay supplies and chemicals and appliances used for assaying.

Class B. Belt, all kinds, and belt fasteners and dressings.

Class C. Miners' lamps, any lamp carried underground—carbide or electric—and carbide or batteries and parts for same.

Class D. All drills for rock drilling and parts for same.

Class E. Electrical material of all kinds—motors, wire, etc.

Class F. Fuels as coal, fuel oil, gasoline, cordwood, etc.

Class G. Groceries—fruit, vegetables, meat—any consumable edible item.

Class GB. Clothing, all kinds—footwear, gloves, etc.

Class H. Hardware—bolts, screws, nuts, rivets and such

Class I. Ordinary bar iron or mild steel, sheet steel.

Class IA. Structural steel as beams, channels, angles, columns.

Class IB. Tool Steel, drill steel, high-carbon special steels.

Class IC. Brass, copper, bronzes—bars and sheets, etc.

Class ID. Miscellaneous metals as babbit, lead, aluminum.

Class J. Automobiles, trucks, tractors, gasoline engines and parts for same.

Class K. Stationery and office supplies as printed forms, ink, desks, etc.

Class L. Lumber, all kinds.

Class LA. Ties for railroad.

Class M. Machinery, as crushers, pumps, cars, locomotives, lathes, and parts for same.

Class MA. Cloth, paper, canvas, such as is mainly used for filtering purposes in ore reduction.

Class MB. Large power excavating shovels and parts.

Class MC. Grinding balls or rods used exclusively for grinding ore.

Class MD. Foundry supplies as fluxes, patterns, and moulds.

Class N. Packing, all kinds, including oakum and candle-wicking.

Class O. Lubricants and lubricators—oil, grease, waste, wipers; also oil cans, grease guns, and lubricating devices.

Class P. Paints, all kinds, glass and putty.

Class Q. Pipe and fittings—all metal pipe and fittings for same for conveying liquids or air.

Class QA. Hose and fittings—rubber hose, air hose, etc., and clamps and connections for same.

Class QB. Plumbing. This includes fixtures which stay in place such as bath tubs, sinks, toilets, and parts for same.

Class R. Railroad supplies as rail switches, spikes, rail bolts, angle bars, switch lamps, metal ties. Wood ties are in Class LA.

Class RA. Scrap rail—used here to keep track of scrap rail for making grinding balls.

Class S. Brick and cement.

Class SA. Building—siding and roofing—as corrugated iron siding, wall board, sheet insulation, prepared roofing, Transite board, etc. Lumber and wood shingles are in Class L.

Class T. Hand tools, all kinds, as hammers, saws, shovels, brooms, etc.

Class U. Welding supplies as welding rods, fluxes, oxygen, acetylene, all strictly welding appliances as torches and parts, solders and carbide for generating acetylene.

Class V. Reagents—applies to chemicals and liquids used in reduction of ore, as cyanide, lime, soda ash, xanthate.

Class W. Rope and cable. Applies to manila rope, wire hoist rope, guy wire, ordinary iron wire and clamps and thimbles for same. Strictly electrical wire and cable is in Class E.

Class X. Explosives—powder, caps, fuse.

Class Y. Camp equipment and supplies, as furniture, stoves, dishes, soaps, cleansers, and polishes.

Class Z. Miscellaneous. To be used for any material which cannot be logically placed in any other class.

Class "Sales." This class covers items purchased for immediate resale, for the most part to employees. This material does not go into operation but is in and out of the books at once. This class should balance out at the end of each month and does not affect the inventory.

house stock may also be stored in the supplementary buildings. In the latter case, it is valuable to have a list of such surplus at the regular stock location and place a blue card marked "Surplus" in a holder on the proper bin to indicate that a reserve supply is available.

Additional to the buildings, a number of racks, sheds, and platforms are required to store such things as pipe, bar and sheet steel, barreled goods, and so on. All these storage places should be numbered. A good idea is to use the words "Section No." in buildings and "Rack No." for open storage.

A railroad spur should run along one side of as many of the supplementary buildings and racks as possible and a wagon road down the other side. These outside storage places should run in straight lines and not be crowded together.

It is important to have a strong fence at least 10 ft. high around the warehouse yard. The front of the main building may form the fence for its length, with the yard fence starting from both ends of the building.

At a large mine it will be found that certain items should not be stored at the main warehouse but near where they will be used. Lumber for mine timbering and general plant work may be stored in separate yards and all used accounted for by taking monthly inventory. Heavy chemicals such as cyanide, soda ash, and the like should go into locked buildings near the concentrating plants. Also, extremely heavy and bulky items such as roll shells, crusher bases, shaft sets, rail and ties may be placed close to where they will go into use. The fewer times and shorter distance such material is moved, the cheaper the cost.

The warehouse crew has charge of issuing all this outside material and check frequently to keep it in line. Care must be used not to allow outside stocks to include any more than is plainly desirable. The main warehouse and yard is the right place for 95 percent of all items.

Blasting powder is necessarily stored at some distance from the plant, and the magazine should be large enough so there is always room to store the last incoming shipment in such position that powder already on hand may be issued first, as powder deteriorates with age. Means of maintaining a temperature of 40 to 50 deg. in the magazine is desirable. Powder is usually drawn only once a day, and all the safety methods, as put out by explosive makers, should be rigidly observed.

If the company sells any considerable amount of clothing to employees, such stock is better handled in a separate storeroom near the main plant entrance gate. Such sales take considerable time and interfere with other work at the main warehouse and waste the workman's time if he must wait around for attention. The separate clothing store may be handled as a branch of the main warehouse. The clerk at the clothing store should supply the time office with a daily list of sales, so that everything will be paid for.

Ordering and purchasing will be discussed next, starting in the November issue.

How Frothers Help Or Hinder Flotation

A. W. FAHRENWALD, Dean of the School of Mines, University of Idaho, Moscow, Idaho

TOO MANY MILL MEN who work with flotation, it seems to me, take frothers too much for granted. Collectors and modifiers of one kind or another have long received the lion's share of attention, although of late the realization has grown that frothers, too, can be of critical importance in flotation. In this paper I wish to present the results of certain investigations into the fundamental relationships between frother and the mineral-collecting power of bubbles in a flotation pulp.

Frothing reagents fall into the category of so-called polar-nonpolar substances—that is, those whose molecules comprise water-avid and water-repellent groups of atoms. Placed in a flotation pulp, which is then beaten into a froth, the frother molecules tend to collect around air bubbles in the pulp, each molecule oriented so that its water-avid group is taken up by the water surrounding the bubble and its water-repellent portion is in contact with the air in the bubble.

The surface tension of the water surrounding a bubble, or in a bubble film at the pulp surface, is lowered by this action of the frother molecules, the amount by which it is lowered depending on the number of such molecules in the water surface.

Time Factor Important

In turn, the quantity of frother molecules in the surface depends on the rate at which their water-repellent portions can pull them there, an act of concentration that is certainly not instantaneous. Therefore, the magnitude of the surface tension for any given reagent and concentration thereof is determined by the age of the surface. This relationship between surface tension and age of surface is a most important factor in flotation in at least two ways: first, it affects the mineral-collecting power of the bubble while it is still in the body of the pulp; second, it affects the persistence of bubble films after the bubbles have arrived at the pulp surface, for unless sufficient frother is present in the bubble film, local stretching (expansion) will succeed in breaking the bubble film.

The surface tension-lowering properties of a number of froth-forming water-solutes are shown in Fig. 1. The time or "age" factor for pine oil is shown in Fig. 2. In relating these data to bubble-water

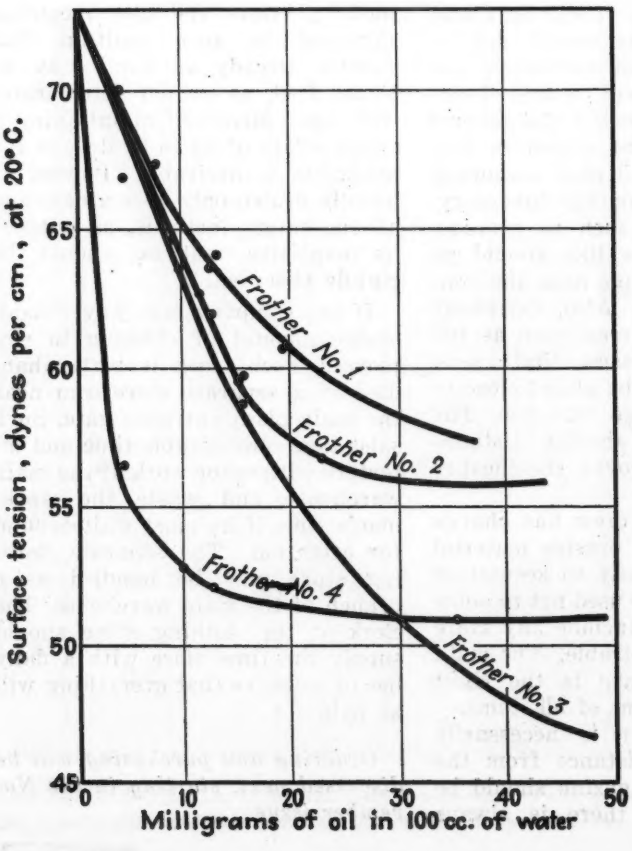


Fig. 1. (Left) Showing how various frothers lower the surface tension of water.

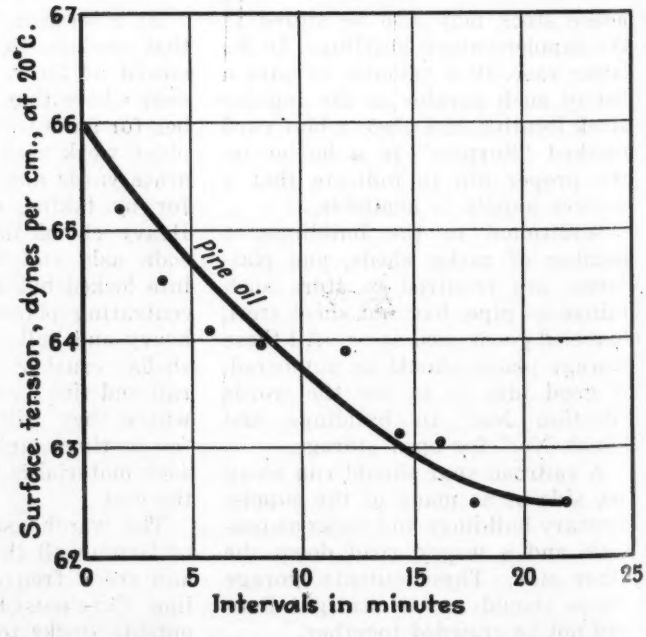
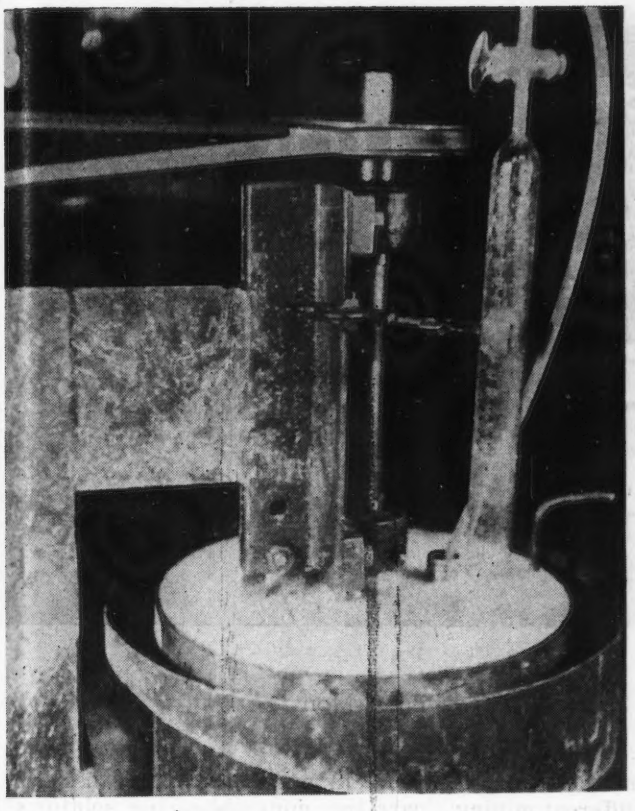


Fig. 2. (Above) Showing that time is a factor in the frother's effect on surface tension.



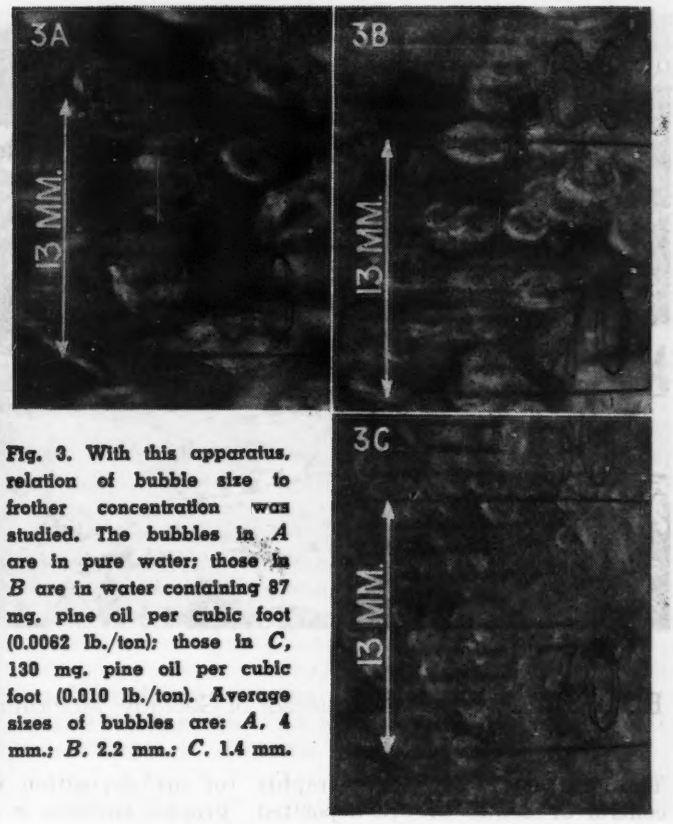


Fig. 3. With this apparatus, relation of bubble size to frother concentration was studied. The bubbles in *A* are in pure water; those in *B* are in water containing 87 mg. pine oil per cubic foot (0.0062 lb./ton); those in *C*, 130 mg. pine oil per cubic foot (0.010 lb./ton). Average sizes of bubbles are: *A*, 4 mm.; *B*, 2.2 mm.; *C*, 1.4 mm.

surfaces that are submerged in the pulp, some difficulty is encountered, for it is not easy, if it is possible at all, to measure the surface tension of bubble-water surfaces. However, that there is a concentration of frother molecules in such surfaces is shown by the fact that in flotation pulps there is a concentration of frother in the foam or mineral froth and a depletion of it in the water or pulp body.

Bubble Surface Contamination

The function of a bubble in a flotation pulp is to collect mineral. Its efficacy in doing so is measured by the bubble's properties, and probably two of the most important of these are: the size of the bubble, and the extent of the concentration in its surface of frother molecules. This latter property may also be stated as the extent of contamination of the bubble surface, for the experience in many plants has been that best mineral recoveries were had when frother was held to a minimum. In the sense that it tends to inhibit the mineral-collecting power of a bubble, a frother must be regarded as a bubble contaminant.

For a given frother concentration, there are a number of factors affecting the extent of bubble surface contamination. One is the age of the bubble, as has already been pointed out; the other is the "specific surface" of the aërated pulp—that is, the units of bubble surface per cubic foot of pulp.

The older the bubble (determined by machine cell depth), presumably the lower its surface tension, the greater its surface contamination, and the lower its mineral-collecting potency. Bubbles at their moment of formation at an impeller presumably have fresh, dynamic surfaces, contamination is at a minimum, and surface tension is at a maximum. The extent of lowering of surface tension with age, as the bubble rises to the surface of the pulp, is not known. Bubbles during their life in the pulp, expand in volume and therefore in surface, a situation all to the good.

Specific Surface

The higher the specific surface of the aërated pulp, presumably the higher the bubble-water surface tension, the lower the surface contamination; and in turn, the better the mineral-collecting potency.

To put it another way, of two identical ore pulps, containing identical frother concentrations, the one subjected to the higher aëration presumably will have the lower bubble surface contamination. Results of practice would seem to bear out this statement, for it is known that the highest recoveries in rougher and scavenger circuits are gained by those machines providing highest and most intense aëration.

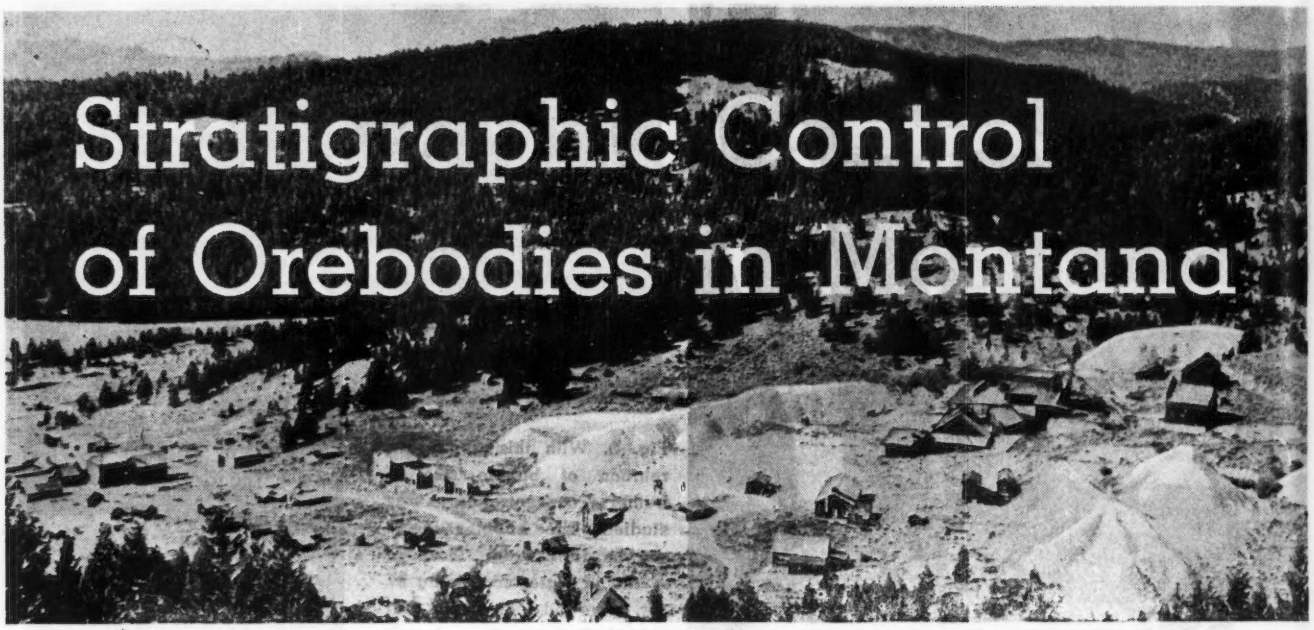
Air bubbles from a Massco-Fahrenwald 1-cu. ft. flotation machine are shown in Figs. 3A, 3B, and 3C. They were reproduced from photographs by Warren Wag-

(Continued on page 155)

Table I. Effect of Frother Addition on Power and Aeration

Pine Oil		Power Consumption,	Aeration,	Density
Mg./Cu. Ft.	*Lb./Ton*	*Watts*	*Cc./Min./Sq. In.*	*of Water*
0	0	280	590	0.900
87	0.0062	270	585	0.880
174	0.0124	269	580	0.860
261	0.0186	263	570	0.840
348	0.0248	262	570	0.830
435	0.0310	260	570	0.825

Stratigraphic Control of Orebodies in Montana



EUGENE S. PERRY, Professor of Geology, Montana School of Mines, Butte, Mont.

THE PRINCIPLE of stratigraphic control of bodies of ore deposited within series of sedimentary rocks is neither new nor unusual. It is a working principle in many mining districts, and its application has facilitated the development of known orebodies and the finding of new ones. However, this principle has been applied but little in prospecting in Montana, even though many important orebodies in this State lie within thick series of sediments.

As one reads the literature on Montana's mining districts, it is difficult to determine if particular stratigraphic positions have been instrumental in localization of ore deposition, and even more difficult to determine if there is a repetition of ore deposition at these stratigraphic horizons in different mining districts. The writer believes that there is a definite stratigraphic control to many of Montana's orebodies which lie in sedimentary rocks, and that ore has been most commonly deposited in rocks at certain positions in the stratigraphic column. This being so, search for new orebodies at these horizons should facilitate prospecting.

Simply stated, the principle of stratigraphic control is that within a region where mineralizing solutions have permeated a series of sedimentary rocks, certain beds, due to chemical or physical characteristics have been more susceptible than other beds to replacement or alteration, and hence mineralization. In particular, where fissures carrying mineral-bearing solutions cut these susceptible beds, ore deposition takes place in the beds in proximity to the fissures. Such beds occur at definite positions within a series of rocks. Commonly limestone, or beds of dolomitic limestone in a series of limestones, are reactive; but stratigraphic control is not limited to limestones and dolomites.

The stratigraphic section in southwestern Montana, where most of the mineralization has occurred, consists of about 5,000 ft. of Paleozoic strata that are mainly limestone and dolomite, but with some zones of shale and quartzite; about 4,000 ft. of Mesozoic strata, mainly clastic sediments; a thick series of upper Cretaceous volcanics (Livingston formation); and extensive Tertiary lake deposits; in all amounting to about a three-mile thickness of bedded rocks.

TABLE OF CAMBRIAN FORMATIONS IN SOUTHWESTERN MONTANA

STANDARD COLUMN	ELKHORN DISTRICT	COOKE CITY DISTRICT	PHILIPSBURG DISTRICT
Devonian dolomite (Jefferson formation)			
Dry Creek (shaly)	Elkhorn	Gallatin	Maywood
Pilgrim (dolomitic)	Cemetery		Red Lion
	?	?	?
Park (shale)	Hobo Gulch		Hasmark
	?		
Meagher (dolomitic)	Starmont	Gros Ventre	
Wolsey (shaly)	(intrusive sill)		? Silver Hill
Flathead (quartzite)	Alpreston	Flathead	Flathead
Pre-Cambrian quartzites and argillites (Belt Series)			

STANDARD AND LOCAL NAMES are given for sequence of correlated Cambrian formations.

Ores Replace Limestones

Of these three miles of strata, dolomites and dolomitic limestones of Cambrian age are outstanding as host rocks for replacement types of ore deposits; Devonian and Mississippian strata are of much less importance; strata from Pennsylvanian to upper Cretaceous (inclusive) are in general insignificant as host rocks; but large high-grade bodies of ore, generally in the form of fissure veins, have been found in

THE ELKHORN MINING DISTRICT, Montana, which produced base and precious metals valued at approximately $15,000,000.

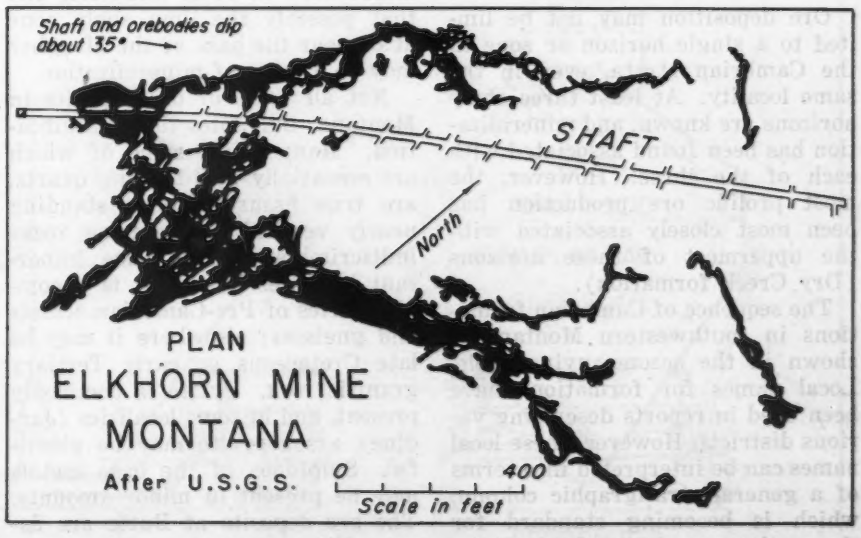
the upper Cretaceous volcanic series. No Ordovician or Silurian strata have been recognized in the mining districts of southwestern Montana, and they are believed to be absent. (At Butte and also elsewhere the host rock for the ore deposits is granitic in character.) Hence, among bedded rocks in Montana, the Cambrian strata and the upper Cretaceous volcanics should receive special study as potential ore bearers. Furthermore, within the Cambrian strata, total thickness of which is about 2,000 ft., evidence indicates that certain horizons or zones of strata have been more susceptible to mineralization than others. In several localities the presence of bodies of shale intercalated between thick masses of limestone or dolomite appear to have produced a damming effect, wherein the rising ore-bearing solutions spread out beneath the shaly zones, and replaced the calcareous rocks immediately beneath, or not far beneath. The base of a shale at the top of the Cambrian strata of Montana (Dry Creek formation) would appear to have been particularly influential in causing ore deposition, because in several important mining districts the magnesian limestone beneath this shaly zone (Pilgrim dolomite) has been a place of ore occurrence. Ore deposits in the Elkhorn district, Philipsburg district, Quartz Hill district, and Cooke City district are examples.

Intense folding and faulting, followed by igneous intrusions, came at or near the close of the Mesozoic era, and mineralization accompanied or followed the igneous intrusions. Ore deposits of southwestern Montana appear to be closely associated with igneous intrusion; in many areas definite contact reactions are evident, but all districts are in the vicinity of igneous activity, either laterally or vertically.

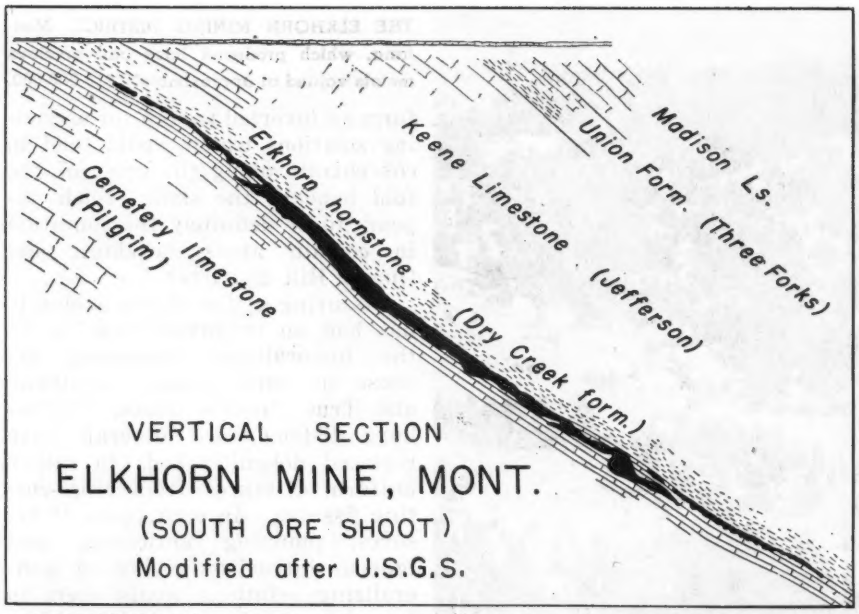
In some localities anticlinal folding appears to have aided in guiding mineral-bearing solutions along definite trends. Folding and faulting throughout all of southwestern Montana were intense and complex. Not only are there closely compressed folds in the strata, but also most folds have a definite plunge, which in extreme cases approaches the vertical. A shale bed on a steeply plunging anticline would form an inverted trough for ascending solutions which would tend to concentrate along the crest of the fold beneath the shale. Such appears to be definitely the condition in certain areas (Elkhorn and Quartz Hill districts).

Fissuring of the strata evidently has had an important bearing on the mineralizing processes, because in some mines (Scratchall and True Fissure mines, Philipsburg district) ore minerals have replaced dolomitic beds to rather uniform distances from cross-cutting fissures. An occurrence of fissures, plunging anticlines, and igneous intrusions giving off mineralizing solutions would seem to have been the most ideal combination.

The ore deposits found within the upper Cretaceous series of volcanic rocks, as previously indicated, are essentially steeply dipping or vertical fissure veins which cut the volcanics more or less indiscriminately. These rocks consist of bedded flows, breccias, tuffs, and agglomerates, andesitic in character. The ore appears to be essentially fissure fillings, and replacement of wall rock is negligible. This suggests that the chemical character of the rock had little bearing on ore deposition. In many, or most, of the mineralized localities, these volcanics form a roof for intruding igneous masses; and it may be that the occurrence of ore deposits within them is incidental and brought about by physical position rather than by chemical character



LARGE SULPHIDE OREBODIES occur here as replacements of dolomitic limestones.



THE OREBODIES follow the dip of the strata for a distance of at least 2,200 ft., and were localized along the crests of two nearly parallel plunging anticlinal folds.

of the rocks themselves. At any rate, so far as known at present, the orebodies in the fissure veins in the volcanics are not related to any particular horizon.

The primary ore minerals occurring in the limestone or dolomite replacement deposits are mainly galena and sphalerite with lesser amounts of chalcopyrite and tetrahedrite; also gold and silver are present. At Philipsburg rhodochrosite is present. Quartz and pyrite are the chief gangue minerals, although locally ankerite occurs. Small amounts of rarer minerals may be present. The mineralogy of the fissure veins in the volcanics is essentially the same as in the replacement deposits.

Three Ore Horizons Known

Ore deposition may not be limited to a single horizon or zone in the Cambrian strata, even in the same locality. At least three shaly horizons are known, and mineralization has been found associated with each of the three. However, the most prolific ore production has been most closely associated with the uppermost of these horizons (Dry Creek formation).

The sequence of Cambrian formations in southwestern Montana is shown in the accompanying table. Local names for formations have been used in reports describing various districts. However, these local names can be interpreted into terms of a general stratigraphic column, which is becoming standard for the southwestern part of this State. It is probable that the use of different names for equivalent strata or formations has obscured the fact that a regional recurrence of ore deposits at particular horizons exists.

Examination of this table shows doubt as to exact equivalents (exact tops and bottoms) in formational correlations for all districts. This is because field work for most of the mine reports was done prior to the recognition of a standard column, and because of a lack of interdistrict correlations based on actual field determinations. Enough information, however, is available to show that the uppermost Pilgrim dolomite has been repeatedly mineralized with large bodies of sulphide ores, that the upper part of the Meagher formation has been mineralized in some localities, and that possibly the limy shaly zone at or near the base of the Meagher may be a locus of mineralization.

Not all veins or ore deposits in Montana fall into this classification. Many veins, some of which are essentially gold-bearing quartz, are true fissure fillings, standing nearly vertical, and cutting rocks indiscriminately. In some important localities host rock is a complex series of Pre-Cambrian schists and gneisses; elsewhere it may be late Cretaceous or early Tertiary granitic rock. Pyrite is commonly present, and in some localities (Jardine) arsenopyrite may be plentiful. Sulphides of the base metals may be present in minor amounts. The ore deposits at Butte are fissure fillings, together with extensive replacements of quartz monzonite adjacent to the fissures. The Butte ore minerals are chiefly chalcocite, bornite, and enargite in the central area, with sphalerite, galena, and rhodochrosite somewhat marginal. Pyrite is the dominant sulphide mineral at Butte, and quartz is the most plentiful mineral encountered in the deposits as a whole.

Perhaps the most outstanding example of stratigraphic control of orebodies in Montana is the Elkhorn mine, about eight miles northeast of Boulder.[1] Large, high-grade bodies of lead, zinc, copper, and iron sulphides containing gold and silver occurred as replacements of upper Cambrian dolomitic limestones or dolomites beneath a persistent shale zone. The orebodies followed down the dip of strata for a distance of at least 2,200 ft., and were localized along the crests of two nearly parallel plunging anticlinal folds. Prior to 1900 this mine produced 8,902,000 oz. of silver, 8,500 oz. of gold, and 4,000,000 lb. of lead. Total value of production is approximately $14,000,000.[2] The name Cemetery limestone, originally used in describing the mine, is equivalent to the name Pilgrim dolomite of the standard section; and the name Elkhorn hornstone is equivalent to Dry Creek formation. The accompanying plan map and cross-section show a distinctive replacement type of orebody, and the relationship of the orebodies to the contact between the Dry Creek shale and the Pilgrim dolomite.

Seek New Orebodies

The working out of the details of stratigraphy in connection with ore occurrence in southwestern Montana is now in progress. Reexamination of the old mining districts, some of which date back to 1880, is planned. Stratigraphy in each locality is to be correlated in terms of a standard geologic column, so that ore occurrence may be thought of in terms of a "common denominator." It is hoped that such information will be of material aid in a search for new orebodies and in the extension of old ones. This work is being carried on by the Montana Bureau of Mines and Geology, headquarters of which is at Butte.

[1]Weed, W. H., U.S.G.S. An. Report; 22d; pt. 2; pp. 399-510, 1901; "Geology and Ore Deposits of the Elkhorn Mining District, Montana."

[2]Knopf, Adolph, U.S.G.S. Bull. 527; "Ore Deposits of the Helena Mining District, Montana."

Noranda Improves Design Of Smelter Calcine Car

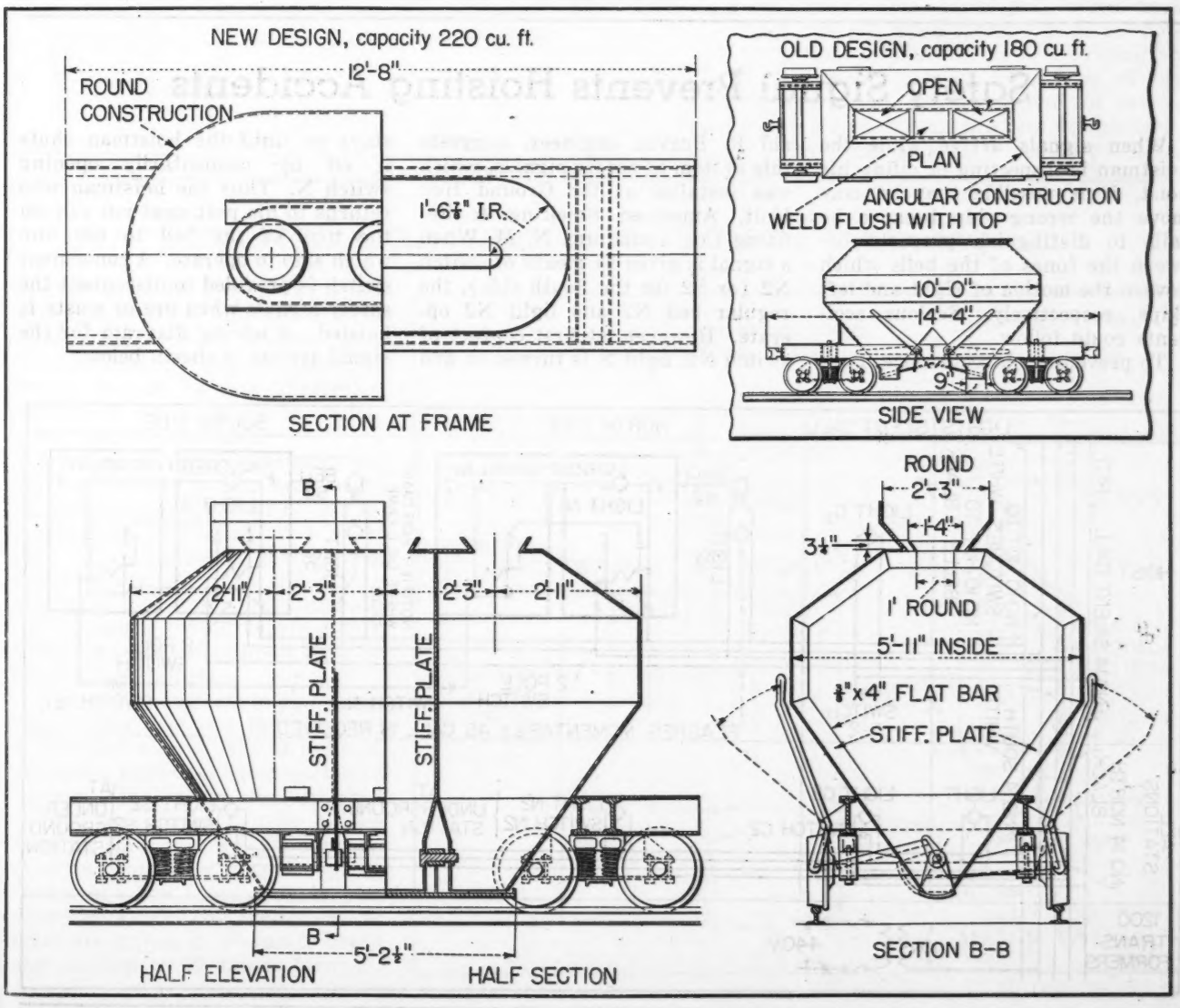
W. DENNISON, Smelter Mechanical Foreman Noranda Mines, Ltd., Noranda, Quebec

SMELTERMEN who still resort to bumping and hammering to dislodge material which hangs up in the corners of a calcine car during unloading operations will appreciate improvements in design of cars at the Noranda smelter. A smooth discharge of calcine was achieved by rounding the corners of the steel car-hopper as shown in the accompanying illustration. The new design also increased the capacity from 180 cu.ft. to 220 cu.ft. without enlarging over-all dimensions of the car, and substituted a more satisfactory type of arc gate for the slide-type of discharge gate formerly used.

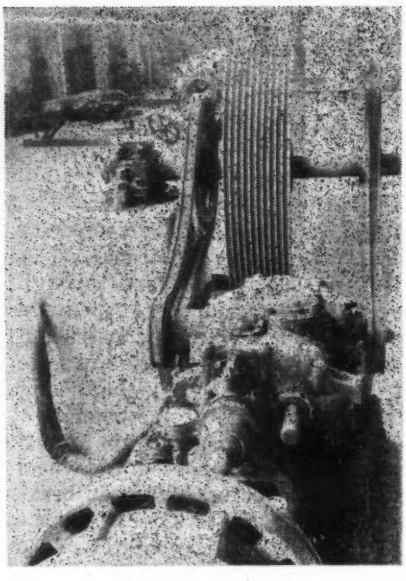
The car is used to transfer hot calcine from discharge hoppers of Wedge multiple-hearth roasters to calcine bins below the charge floor of reverberatory furnaces. Temperature of the calcine is approximately 1,200 deg. F., and capacity of the cars is 10 to 12 tons.

Calcine enters the cars through three 12-in. diameter openings around which a collar is constructed to prevent spills. A single arc gate 8¾ in. wide by 5 ft. 2½ in. long controls discharge of the calcine.

The hopper is mounted on a steel I-beam frame supported by wheel assemblies fitted with Timken bearings. Track gage is 4 ft. 8½ in.



OPERATING IDEAS



Truck Transmission Regulates Rotating Speed of Kiln

Operators at the property of the Vanadium Corporation of America, Ricran, Peru, were faced with the problem of slowing down the speed of an 8x125-ft. roasting kiln from 1 r.p.m. to a fraction of an r.p.m. to improve efficiency of performance. As is often the case in isolated foreign camps, the lack of suitable speed reducers and motors demanded an improvised solution. Meeting the emergency, Walter Fiedler, chief mechanic, connected the drive shaft coupling of an old Mack truck transmission directly to a 30-hp., 865-r.p.m. motor. Two jack-axles of the transmission were then connected to the former drive wheel by two sets of chains and sprockets as shown in the accompanying photograph.

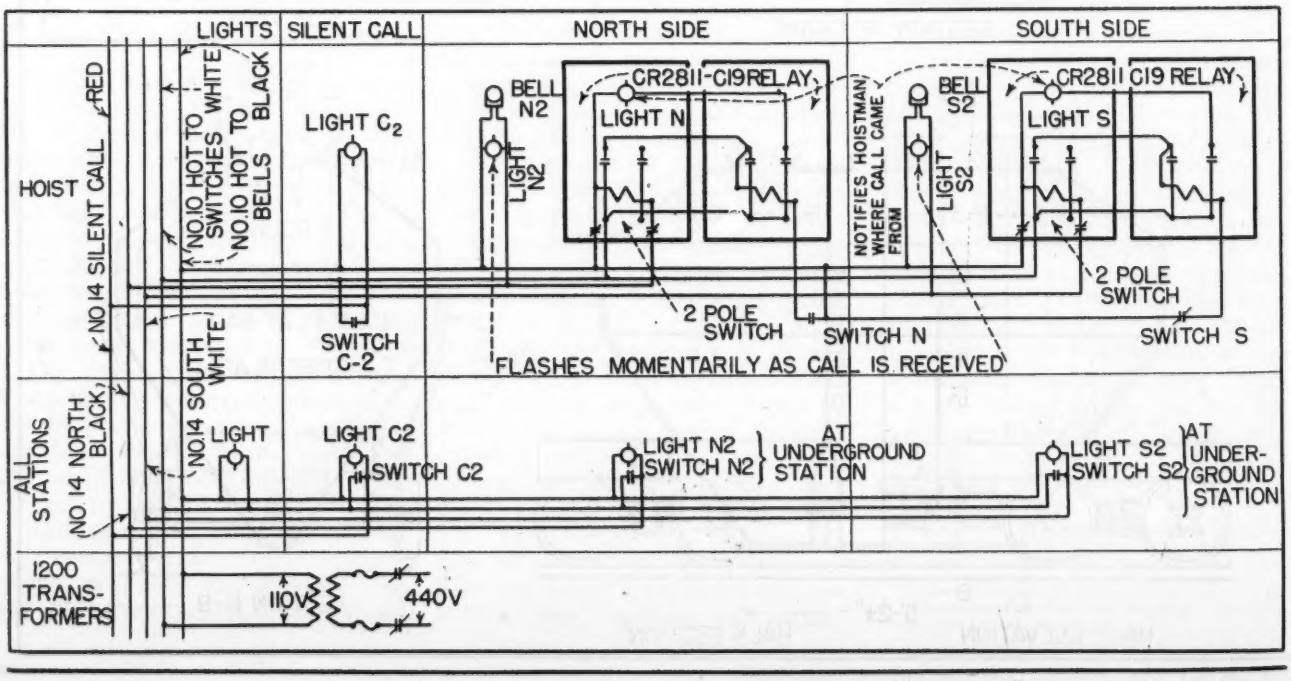
To obtain slow rotation, the transmission was thrown into low gear, thereby reducing the speed from 1 r.p.m. to 1/5 r.p.m. By merely throwing a lever, two additional speeds forward and one speed reverse can be obtained.

This improved reducing system has been in 'round-the-clock operation for over six months and continues to function satisfactorily, according to Robert Preuss, metallurgist, who submits the idea.

Safety Signal Prevents Hoisting Accidents

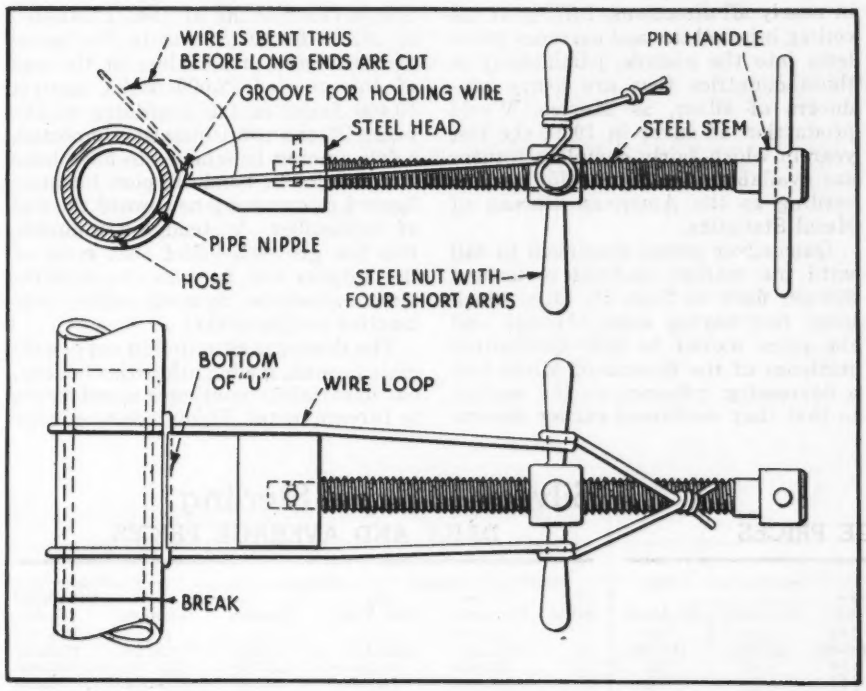
When signals arrive while the hoistman is inspecting or oiling his hoist, it is possible that he may move the wrong skip because he fails to distinguish properly between the tones of the bells which govern the motion of right and left skips, respectively. Serious accidents could follow.

To prevent such occurrence, Donald R. Purvis, engineer, suggests this system of safety signals, which was installed at the Ground Hog Unit, American Smelting & Refining Co., Vanadium, N. M. When a signal is given by means of switch N2 (or S2 for the South side), the regular bell N2 and light N2 operate. However, at first contact of switch N2, light N is turned on and stays on until the hoistman shuts it off by momentarily opening switch N. Thus the hoistman who returns to his post need not rely on the tone of the bell to tell him which skip to operate. A convenient switch is provided to disconnect the safety signals when ore or waste is hoisted. A wiring diagram for the signal system is shown below.



Hose Clamping Device Built in Mine Shop

A STRONG, AIR-TIGHT WIRE HOSE clamp may be applied with the illustrated equipment which can be built in any machine shop. It consists of a steel head with a groove at the tapered end to hold the wire and a hole at the other end in which a threaded steel stem revolves freely, and a special nut with four short arms at right angles which serve as a handle and a projection for fastening the wire during actual binding of the hose.



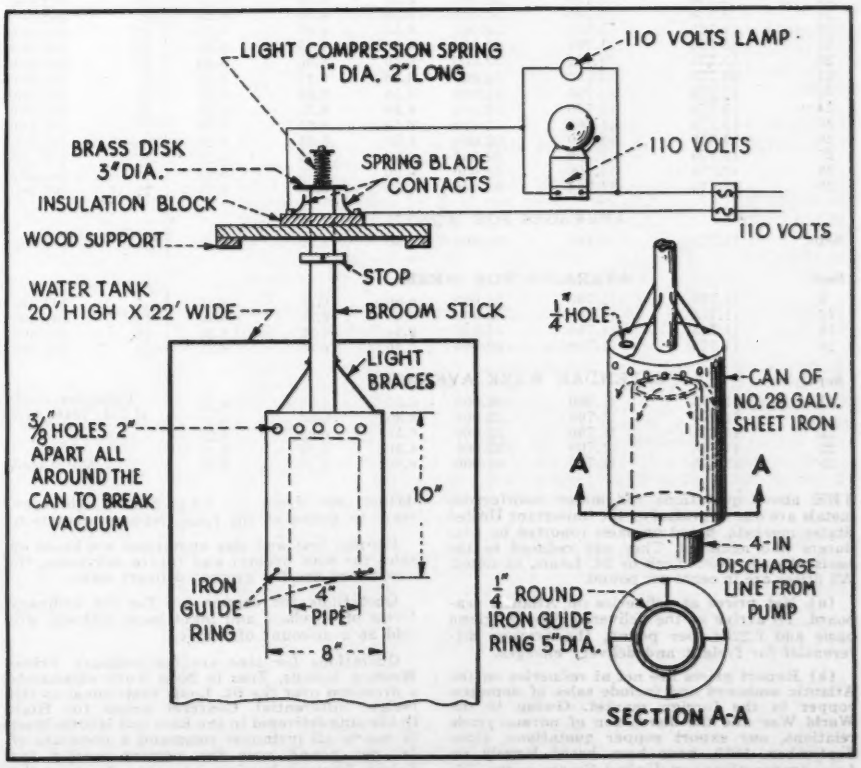
The broken section of the hose is joined by a short pipe nipple and is clamped as follows: A piece of soft steel wire 20 to 24 in. long, bent into the shape of a long square-bottom "U," is looped into a clamp and slipped over the end of the hose. Next, the groove in the head of the tool is placed into the straight bottom of the "U." Loose ends of the wire are wrapped tightly around the arms of the central nut and given a final twist on the far side to prevent unwrapping. Then the wire clamp is tightened up by holding the nut with one hand and turning the pin handle of the stem with the other, which automatically pushes one end of the wire forward while the other one is drawn back. When the wires are sufficiently tight, the device is swung over in an arc of about 180 deg. This turns the wires back sharply upon themselves at the bottom of the "U," thus providing an automatic lock. Long ends of the wire are snipped off and the newly-cut short ends are bent down sharply against the surface of the hose.

Inverted Can Operates Water Pump Signal

OPERATORS at the property of Chromite, Ltd., St. Cyr, Quebec, are notified when a water supply pump fails because of loss of prime or power failure by the illustrated equipment designed by P. Stiernotte, master mechanic.

A two-stage centrifugal pump operating under a suction head of 10 ft. and a discharge head of 395 ft. is situated a half mile from a water tank. If pumping is interrupted, the 8-in. can over the end of the discharge pipe drops and automatically closes a switch which sounds a warning bell, or lights a lamp in case of bell failure.

A five-in. ring of ¼-in. round iron, which encircles the pipe and is attached to the base of the can, assures a guided vertical motion of the can. The broom stick attached to the top of the can is guided through holes in a wooden support. Positive contact between the spring blades and the brass disk is produced by a light coil spring. Small holes are drilled in the can to break any vacuum which might form.



MARKET SUMMARY

OUTSTANDING IN PRICE developments during September was the sharp advance in foreign silver. Effective Sept. 21, OPA raised the ceiling price from 45c. a fine ounce to 71.111c., which established quotations for both foreign and domestic metal at the same level. The New York Official for foreign silver was raised to 70⅝c. On Sept. 24, London dealers raised their quotation from 25½d. to 44d. Trading in foreign silver during most of September was virtually suspended pending receipt of word from Washington on what OPA had in mind in reference to correcting the disparity in prices. That the ceiling would move to parity with the domestic price was not generally expected. The single price level can be maintained if demand continues to absorb the supplies that are likely to increase, trade authorities believe. However, up to the end of the month the price situation was viewed as firm in nearly all directions. Lifting of the ceiling injected tax and currency problems into the picture, particularly in those countries that are heavy producers of silver, as Mexico. World production of silver in 1939, the last year in which fairly complete returns are available, was 257,907,755 oz., according to the American Bureau of Metal Statistics.

Quicksilver prices continued to fall until the market declined to around $90 per flask on Sept. 20, after which some fair buying came through and the price moved to $93. Quicksilver statistics of the Bureau of Mines had a depressing influence on the market in that they confirmed earlier reports of heavy importations and large accumulations in the hands of consumers and dealers. General imports in the first seven months of 1945 amounted to 47,180 flasks. Stocks in the hands of consumers and dealers at the end of July totaled 32,000 flasks, against 10,400 flasks at the beginning of the year. Of the total quantity imported, a fair amount is believed to have been stored here in bond. Export business figured in transactions toward the end of September. A steadying influence was the growing belief that most of the surplus will go into the Government's stockpile. Spanish sellers were inactive in this market.

The domestic situation in copper remains sound, trade authorities believe, but uncertainty continues in reference to foreign metal. Though demands for

Major Metals

U.S. DAILY AND AVERAGE PRICES

1945 Sept.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	11.775	11.700	52.000	6.50	6.35	8.25
3	Holiday	11.700	Holiday	Holiday	Holiday	Holiday
4	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
6	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
12	11.775	11.700	52.000	6.50	6.35	8.25
13	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
			AVERAGES FOR MONTH			
Sept.	11.775	11.700	52.000	6.50	6.35	8.25
			AVERAGES FOR WEEK			
Sept. 5	11.775	11.700	52.000	6.50	6.35	8.25
12	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
			CALENDAR WEEK AVERAGES			
Sept. 1	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
22	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1945 Sept.	Sterling Exchange: "Checks" (Nominal)	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	402.600	(c)	(c)	(c)	$35.000
3	Holiday	Holiday	25.500	172s. 3d.	Holiday
4	402.000	44.750	25.500	172s. 3d.	35.000
5	402.000	44.750	25.500	172s. 3d.	35.000
6	402.000	44.750	25.500	172s. 3d.	35.000
7	402.000	44.750	25.500	172s. 3d.	35.000
8	402.000	(c)	(c)	(c)	35.000
10	402.000	44.750	25.500	172s. 3d.	35.000
11	402.000	44.750	25.500	172s. 3d.	35.000
12	402.000	44.750	25.500	172s. 3d.	35.000
13	402.000	44.750	25.500	172s. 3d.	35.000
14	402.000	44.750	25.500	172s. 3d.	35.000
15	402.000	(c)	(c)	(c)	35.000
17	402.000	44.750	25.500	172s. 3d.	35.000
18	402.000	44.750	25.500	172s. 3d.	35.000
19	402.000	44.750	25.500	172s. 3d.	35.000
20	402.000	44.750	25.500	172s. 3d.	35.000
21	402.000	70.625	25.500	172s. 3d.	35.000
22	402.000	(c)	(c)	(c)	35.000
24	402.000	70.625	44.000	172s. 3d.	35.000
25	402.000	70.625	44.000	172s. 3d.	35.000
26	402.000	70.625	44.000	172s. 3d.	35.000
27	402.000	70.625	44.000	172s. 3d.	35.000
28	402.000	70.625	44.000	172s. 3d.	35.000
29	402.000	(c)	(c)	(c)	35.000
		AVERAGES FOR MONTH			
Sept.	402.000	52.921	30.125	—	35.000
		AVERAGES FOR WEEK			
Sept. 5	402.000	44.750	—	—	
12	402.000	44.750	—	—	
19	402.000	44.750	—	—	
26	402.000	65.450	—	—	

Calendar week averages, New York Silver: Sept. 1st, 44.750; 8th, 44.750; 15th, 44.750; 22nd, 49.925; 29th, 70.625.

(c) *Not quoted* (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c. per troy ounce. Handy & Harman's quotation on newly-mined domestic silver 999 fine was 70⅝c. throughout September.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

copper from liberated European countries have been increasing, the important question of what the United States intends to do about terminating foreign contracts has not yet been settled. Demand for copper in this country has been sufficient in volume to absorb domestic production, plus a good tonnage of MRC metal. Fabricators consumed 98,171 tons of copper during August, against 79,739 tons in July. Production of refined copper amounted to 69,127 tons in August, against 72,995 tons in July, the Copper Institute reports.

Lead allocation for the fourth quarter was eased by WPB to permit an expansion in output of white lead. Demand for lead was active throughout September and foreign metal was released in quantity by WPB to take care of the needs of consumers.

WPB revealed that stocks of zinc (in concentrate and in slabs) total 801,800 tons, of which 501,700 tons is owned by the Government. Foreign purchases are being discontinued and selling pressure from abroad is viewed as a possibility.

Miscellaneous Metals Monthly Averages

Average prices of miscellaneous metals for August and September.

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

	Aug.	Sept.
Quicksilver, N. Y. flask	123.200	95.842
Antimony (a)	15.839	15.839
Antimony, bulk, Laredo	14.500	14.500
Antimony, bulk, N. Y.	15.265	15.265
Antimony, Chinese (b)	16.500	16.500
Platinum, oz. troy	35.000	35.000
Cadmium (c)	90.000	90.000
Cadmium (d)	92.500	92.500
Cadmium (e)	95.000	95.000
Aluminum ingot	15.000	15.000

E & M J Price Index

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

1929	110.33	1937	90.86
1930	82.87	1938	73.67
1931	60.20	1939	77.71
1932	48.26	1940	79.22
1933	59.79	1941	83.49
1934	69.59	1942	86.80
1935	74.66	1943	88.74
1936	73.45	1944	88.74

	1943	1944	1945
January	88.74	88.74	88.74
February	88.74	88.74	88.74
March	88.74	88.74	88.74
April	88.74	88.74	88.74
May	88.74	88.74	88.74
June	88.74	88.74	88.74
July	88.74	88.74	88.74
August	88.74	88.74	88.74
September	88.74	88.74	91.16
October	88.74	88.74	....
November	88.74	88.74	....
December	88.74	88.74	....

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated
(Oct. 1, 1945)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb.	15c.
Antimony, domestic, spot, lb., 5 tons or more	15.839c.
Bismuth, ton lots, lb.	$1.25
Cadmium, commercial sticks, lb.	90c.
Calcium, lb., ton lots, 97 @ 98 percent, cast	$1.85
Chromium, 97 per cent grade, lb.	89c.
Cobalt, 97 to 99 per cent, per lb.	$1.50
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 per cent, carloads, lb.	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation) troy oz.	$35.00
Quicksilver, flask of 76 lb., 100 flasks or more	$93.00
Selenium, 99.5 per cent, lb.	$1.75
Silicon, minimum 97 per cent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$12.50 nom.
Titanium, 96 to 98 per cent, lb.	$5.00

METALLIC ORES

Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit	$10.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$41.00
48% Cr_2O_3 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.01
Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 per cent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 60 per cent, duty paid	$24.00
Domestic, 60 per cent and upward	$24.00@$24.50
Vanadium Ore, per lb. of contained V_2O_5 f. o. b. mines	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.: per ton	$55.28
(a) Prices at mines, small lots, normally several dollars less.	

METALLIC COMPOUNDS

Arsenic Oxide (arsenic) lb.	4c.
Cobalt Oxide, 70 @ 71 per cent, lb.	$1.84
Copper Sulphate, 100 lb.	$5.00

ALLOYS

Beryllium Copper, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent per lb. of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum, 55 @ 65 per cent Mo, lb. of Mo contained	95c.
Ferrosilicon, 50 per cent, per lb. of contained Si	6.60@8.10c.
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V delivered	$2.70@$2.90
Silicomanganese, 1 per cent C, gross ton	$133.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U.S. funds), ton:	
Crude No. 1	$650@$758
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$8.50@$9.00
Missouri, 93 to 94 per cent $BaSO_4$, per short ton	$8.25@$8.50
Bauxite, long ton:	
Domestic, crude, 50 @ 52 per cent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 60 per cent, all rail movement, ton	$30.00
Acid 98 and 1 per cent, bulk, ton	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica — Colonial Mica Corp., agent for Metals Reserve Co., quotes full-trimmed ruby muscovite domestic, April 1 to Sept. 30, inclusive — No. 1, $1.70 to $36.65 per lb., depending on size; No. 2, $1.25 to $26.00; No. 2 Inferior, 50c. to $16.00; No. 3, 25c. to $6.25. Prices f.o.b. nearest producer's rifting plant.	
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c i f. Atlantic ports	12c. nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$24.50
Steel, base price, Pittsburgh Billets, gross ton	$36.00
Structural shapes, 100 lb.	$2.10

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Handling Metal Subsidies After WPB's Dissolution

The question of what agency is to carry on the War Production Board's work on premium prices after that body winds up its affairs was without official answer as September ended.

The Bureau of Mines and other divisions of the Department of the Interior have made no moves that could be interpreted as an attempt to take over Quota Committee's job. OPA, it is known, is willing to assume the duties on short notice.

Inquiry at RFC revealed that the historic policy of "do nothing unless requested" is still in effect just as it was in January 1942, when the then Federal Loan Administrator, Jesse Jones, first announced the Premium Price Plan in a letter to Knudsen and Henderson—"You are advised that, in accordance with your suggestion, Metals Reserve Co. will, at your request, for a period of 2½ years from Feb. 1, 1942, pay . . ." (*E.&M.J.*, Feb., 1942, p. 107.)

Excuse for the do-nothing policy at RFC is the possibility that subsidy payments for over-quota production of copper, lead, and zinc may be stopped before the end of the fiscal year 1946. The President's statement when he signed Public Law 88 that he would request legislation to permit a reduction in subsidies if the present level of payments was not required for war purposes, and his later statement in a press conference on Aug. 23 that the Government will end subsidy payments on copper, lead, and zinc when it has been determined that subsidies are unnecessary, were cited as reasons for RFC's attitude.

Washington observers do not believe that Congress will take action to stop premium price payments. Quite the contrary is the belief of Government mining experts. Here are some of the arguments they advance privately:

If the premiums are discontinued, a new and higher ceiling price would have to be set for copper, lead, and zinc in order to maintain production. This applies particularly to lead. However, a decline in production of the premium metals under a higher price would result. Big operators would be able to carry on much of their deferred development work under a higher ceiling, but the price could not be set high enough to keep the small high-cost producers in business.

Congress would not permit the little fellows to be killed off. It bleeds for small business.

Another view is that most RFC loans to mines have been to small operators. Big mining companies have been strong enough to finance the enlargement of their facilities with their own funds. It is argued that Government savings that might result from a curtailment of subsidy payments would be reduced by the number of RFC loans that would be in default as a result of the curtailment.

It is also evident that any horizontal rise in the base price of metals is contrary to OPA policy and to the policy of organized labor. The Administration is committed to price stabilization. The Administration is sensitive to the wishes of labor.

Of all Government agencies that might be interested in taking over the operation of the Quota Committee, only OPA was showing any interest in September. Its officials on the operating level were preparing to enlarge their staffs to provide a soft spot for the Quota Committee to light on should the transfer be made to OPA.

Early Cancellation of Premiums Unlikely

Threats to end premium payments before June 30, 1946, the present legal expiration date, are not considered dangerous in Washington. The belief held by most is that President Truman is trying to forestall a continuation of subsidies beyond the end of the present fiscal year. The history of subsidy payments shows that once started it is difficult to get them stopped.

The Premium Price Plan has shown surprising strength and longevity in spite of the termination provisions included in the original documents. There is some reason to believe that a determined effort will be made in Congress to continue the plan on a permanent basis as an integral part of the full-employment program put together by Government planners.

The President, having made his case for early cancellation of premium payments, is in position to bargain. It is unthinkable that an astute politician would risk an open break that an attempt at early cancellation of the plan would certainly bring.

In his message to Congress the President approached the subject obliquely in these words:

"Subsidies for purposes other than food are also being reviewed by the agencies concerned, who are collecting the necessary data for an orderly liquidation at the earliest date compatible with the stabilization program. Those subsidies which were designed originally to stimulate increased production should not be removed at a time or in a manner to incite inflation and upset our economy. I have directed that early reports be made on this important problem."

OPA Lifts Ceiling on Foreign Silver to 71.111c

After a month of uncertainty in foreign silver circles, during which period gossip had it that an upward revision of the ceiling price on foreign metal was imminent, the Office of Price Administration got around an involved situation by lifting the ceiling to the same basis as that which has obtained for domestic metal since 1939. Effective Sept. 21, OPA increased the ceiling from 45c. a fine ounce to 71.111c., the top figure being identical with that established for domestic silver by the Treasury before the war.

An extraordinary demand came into the market for foreign silver as soon as WPB controls were lifted. The buying interest originated with manufacturers of silverware, and industrial consumers, including the photographic industry. With foreign silver priced here on the basis of 45c., no one cared to acquire domestic metal at 71c. Moreover, silver was selling abroad at a premium over the 45c. level, in some instances above 60c.

The scramble for silver even brought out suggestions aimed at raising the domestic price to its full monetary value—$1.29 an ounce. This was viewed in Washington as an opening gun against the extension of the Green Act. The measure sponsored by Senator Green provided that surplus Treasury silver could be released for war purposes and civilian production on the basis of 71.111c. It became law on July 12, 1943.

Two schools of thought were in evidence in Washington on the desirability of higher silver prices. One, of which Senator McCarran may be considered a spokesman, desired a higher price in the belief that silver is a precious metal. This group apparently feels that by pushing the price higher, silver can be made desirable for true coinage, reversing the world trend.

Others held to the belief that an artificially high price hinders the orderly development of industrial uses for silver. It also was argued that as the price goes up the interest in silver for subsidiary coinage goes down, and that too high a price will make the use of copper, nickel, and other base metals for coinage desirable.

WPB Dissolves Nov. 3—New Agency Takes Over

The War Production Board is to dissolve on Nov. 3. President Truman has accepted the resignation of J. A. Krug, chairman of WPB, and issued an order creating the Civilian Production Administration to take over remaining WPB functions. J. D. Small has been named administrator of CPA.

The organization succeeding WPB will use its authorized powers to expand production of materials which are in short supply; limit the use of materials which are still scarce; restrict the accumulation of inventories so as to avoid speculation and hoarding; grant priority assistance to break bottlenecks that would impede the reconversion process; facilitate the fulfillment of relief and other essential export programs; and allocate scarce materials.

Five main bureaus are to handle the task of terminating WPB operations:

1. Industrial Reconversion Operations—To deal with problems affecting particular industries which produce or consume scarce raw materials and products such as rubber, forest products, tin, lead, and some other minerals.

2. Reconversion Priorities — Responsible for the modification of general priorities and allocation controls (as distinct from the problems of particular industries), the internal clearance of agency actions, appeals, inventory problems, compliance, and relationships with other government agencies.

3. Field Operations — Concerned with operations in the field including compliance.

4. International Supply — Concerned chiefly with imports and exports.

5. Demobilization — Covers functional demobilization and transfers, budget, personnel, and administrative services.

Attorney General Clark Asks Split-Up of Alcoa

Recommendations of Attorney General Clark that the Aluminum Company of America be split into a number of independent, competing companies followed close on the cancellation of Alcoa's wartime leases of Government-owned plants and announcement of the Senate Small Business Committee's 18-point program for the disposal of Government-owned light-metal plants. "The subdivision of Alcoa into a few independent companies," said the Attorney General, "would lighten considerably the task of creating a truly competitive pattern in the aluminum industry."

The Attorney General suggests the establishment of a single strong competitor of the Aluminum Company of America through subsidy and through the disposal of Government-owned plants or the vertical division of Alcoa into a number of strong integrated companies. The report does not suggest the horizontal division of the company, which would provide competing companies at each level.

After outlining the possibility for tremendous expansion in the use of aluminum and the employment which would thereby be created, the Attorney General concludes that "competition must be firmly and unmistakably established if that result is to be achieved." The Attorney General provided that three steps should be taken at once.

"1. In its disposal of property in this industry, the Surplus Property Board should be guided by the necessity of creating competition in the production of aluminum;

"2. A complete survey ought to be made of all available bauxite reserves in this country, especially these held by Alcoa and other large companies;

"3. Engineering studies should be carried on to determine power costs at various DPC producing plants and the possibilites of relocation of various plants and to determine the feasibility of cutting down the size of the larger DPC plants."

The conclusions of the Attorney General are at variance with those of the U. S. Circuit Court of Appeals for the Second Circuit in the findings of the court written by Judge L. Hand. It contains this observation:

"It is as idle for the plaintiff to assume that dissolution will be proper, as it is for 'Alcoa' to assume that it will not be; and it would be particularly fatuous to prepare a plan now, even if we could be sure that eventually some form of dissolution will be proper. Dissolution is not a penalty but a remedy; if the industry will not need it for its protection, it will be a disservice to break up an aggregation which has for so long demonstrated its efficiency."

It is quite evident from conversation with officials of the Aluminum Company of America that that organization would welcome competition with money, brains, and courage. It is on the question of how this is to be brought about that there is wide divergence of opinion. In its formal reply to the Attorney General's report, Alcoa states that Government-owned plants account "for 57 percent of the capacity of the industry as contrasted to 36 percent for Alcoa and 7 percent for Reynolds Metals Co.

The company and the Attorney General agree on the future market for aluminum, but Alcoa contends it is unlikely that the use of aluminum will reach its full potential if the industry is operated on a Government subsidy, an alternative advanced by Mr. Clark. The Attorney General's proposal also lacks a suggestion of how to handle the matters of taxes, division of personnel, and depreciation of values which would result from a dismemberment of Alcoa.

Behind the charges and countercharges resulting from the Attorney General's report there is the strong suspicion that the proponents of public power are afraid the largest project in the country, Bonneville Dam, will fall flat on its economic face if the Government-owned reduction plants in the Pacific Northwest should stop operation. The question of how the Northwest ingot-making capacity is to compete for the available business in a peactime economy is a problem which is vexing the Surplus Property Board.

Texas Tin Smelting Rests On Future Ore Supplies

The renewal of the Bolivian tin purchase contract announced Sept. 10, covering the period from July 1, 1945, to June 30, 1946, touched off speculation on the postwar possibilities for the operation of the Texas tin smelter.

As the original management contract with the Dutch interests specified the termination date to be April 5, 1947, or when the United States stops purchasing Bolivian concentrates, whichever is later, it is safe to say the Longhorn smelter will continue at least until mid-1946.

The latest official report on tin states:

"Our receipts of tin concentrates during 1946 from our present wartime sources will probably be less than during 1945. This will be due to an anticipated lower output from Bolivia, although it appears that we will receive a part of the Patiño concentrates as we have during 1944 and 1945. A large tonnage of concentrates from the Belgian Congo may be converted into pig tin at the Union Minière du Haut-Katanga tin smelter in Hoboken, Belgium, and sold to European consumers.

"The end of the fighting in the Far East has altered the picture for 1946. At present no authoritative word has been received regarding tin supplies in that area. If conditions are found to be better than was anticipated, it is possible that we may receive, as our share of the total available pig tin or tin in concentrates found on hand or produced in the next year or so, a sufficient tonnage to offset the drop in receipts from our present sources of supply, or to even increase our total new supply.

"Soon the Arnhem, Holland, smelter of the Billiton Co. will be ready to operate, and the Belgian tin smelter of the Union Minière du Haut-Katanga will shortly be ready to receive concentrates. It will be only a matter of time before the great plants in the Straits Settlements of the Straits Trading Co., Ltd., and the Eastern Smelting Co., Ltd., are ready to operate. In fact, recent cables have indicated that Penang smelter of the latter company is intact."

NEWS OF THE INDUSTRY

WPB Tin Statistics Reveal Shrinking Stocks

Though consumers of tin believe that the world's supply of the metal is likely to increase in the next six months, the War Production Board continues to view the situation as critical. Statistics released Sept. 13 indicate that surplus stocks of tin have been falling steadily, and control over consumption remains essential under present conditions.

Chairman Krug of the War Production Board declared that missions are being sent to the Far East by the British and Netherlands governments to report on developments in that area, and the United States will expedite delivery of tin-producing equipment requested by the Netherlands.

The position of primary tin is summarized by WPB, in long tons:

	1945, Restricted Basis	1946, Restricted Basis	1946, Unrestricted Basis
Consumption	65,000	65,000	90,000
Receipts (a)	48,425	32,275	32,275
Deficit	16,575	32,725	57,725

(a) Includes pig tin and tin contained in concentrates.

Estimated receipts of 48,425 tons of tin in 1945 will consist of 32,550 tons from Bolivia, 13,650 tons from the Belgian Congo, 200 tons from the French Cameroons, 75 tons from Mexico, 1,946 tons from China, and 4 tons from the United States.

Imports of tin in concentrates and as metal totaled 169,543 long tons in 1941; 55,854 tons in 1942; 37,805 tons in 1943; 49,875 tons in 1944; and 20,982 tons in the first half of 1945. Imports by countries of origin, in long tons, for 1944 and the first six months of 1945:

	1944	Jan.-June 1945
In concentrates:		
Argentina	42	.....
Belgian Congo	7,549	3,271
Bolivia	28,730	11,709
Fr. Cameroons	177	93
Mexico	39	13
	36,537	15,086
As metal:		
Belgian Congo	10,000	3,950
China	3,338	1,946
	13,338	5,896
Total imports	49,875	20,982

Production of pig tin at the Texas City smelter amounted to 30,619 tons in 1944, and 23,494 tons in the Jan.-July period of the current year. Production in July totaled 3,548 tons, the highest monthly total since operations began in April, 1942. Estimated production at the smelter for 1945 is 41,089 tons. The smelter has been a thorough success, WPB observes, producing the highest grade of tin from low-grade complex ores, and the future of this plant will be watched with interest.

Secondary tin recovered in this country in 1944 and the first half of 1945:

	Pig Tin	In Alloy	Totals
1944	3,790	24,333	28,133
Jan.-June, 1945	1,502	12,400	13,902

Stocks of tin in government and private hands, since the beginning of 1941, long tons:

	Concentrate (a)	Pig Tin (b)	Total Supply
Jan. 1, 1941	Nil	87,656	87,656
Jan. 1, 1942	23,245	120,125	143,370
Jan. 1, 1943	36,725	107,636	144,361
Jan. 1, 1944	40,303	85,241	125,544
Jan. 1, 1945	41,097	66,115	107,212
July 1, 1945	36,586	58,986	95,572

(a) Tin content. (b) Includes small amounts of bar tin, anodes, powder, and recoverable tin in alloy scrap, etc.

The War Production Board estimates that the surplus stocks of tin in government and private hands, after deducting necessary working stocks, but excluding Treasury Procurement and Navy reserves, was 39,932 tons at the end of the first half of 1945, against 52,158 tons at the beginning of the year.

Slow Recovery Seen for Belgium's Zinc Industry

SPECIAL CORRESPONDENCE

Like most Belgian industries, zinc production suffers from lack of coal and imported raw materials. Coal, which was produced in Belgium before the war at the rate of about 100,000 tons per day, is now being mined at only 50 percent of capacity. To attain pre-war production, at least 50,000 skilled miners are needed, which was about the number of foreign miners employed in Belgium before the war. Since 1940 all foreign miners have been compelled to leave the country. By gradually increasing the labor force, it is believed that prewar production of coal may result in about a year. All fuel at present is being reserved for essential needs.

Arrivals of zinc concentrate have been light, owing to the scarcity of shipping space. This situation, however, should ease now that Japan has been defeated.

The zinc smelters of Belgium have not suffered serious damage from direct war blows, but the plants are old, have been idle, and have been in poor repair for years. Full production of zinc can be achieved only at great expense, and may require from two to three years. The Dumont of Slaigneaux plant has been dismantled and will not reopen. The other zinc smelters, four in number, have maintained an interest in the metallurgy of zinc, but do not expect to attain their prewar level of production for some time, if ever. They are virtually idle, and must get along on 3,000 tons of zinc concentrates and 3,000 tons of coal per month. This permits production at the rate of about 10 percent of the prewar level. Concentrates moving into Belgium will come first from the Kipoushi mine of Union Minière, Belgian Congo, and from the Swedish mines of Vieille-Montagne.

Lack of foreign contacts does not allow one to draw serious conclusions so far as the future is concerned. But it is strongly feared that it will be a difficult task to recover Belgium's prewar zinc market.

Sulphuric acid consumers before the war leaned on the zinc industry for their supplies. About one-half of the lead chambers have been dismantled by the Germans to recover the lead. It is planned to erect contact plants to replace the dismantled lead-chamber acid plants. The need for acid is much greater than the need for zinc, owing to the urgent demands from fertilizer and glass plants. Sulphuric acid plants are burning imported brimstone, and production of acid soon should attain 12,000 tons per month, sufficient for Belgium's needs.

Mercury Stocks Rise As Consumption Declines

The Bureau of Mines reported the following July statistics for mercury in terms of 76-lb. flasks:

	U. S. Production	(a) General Imports
1944	37,688	19,819
1945:		
Jan.	2,500	846
Feb.	2,700	2,835
March	3,000	2,263
April	3,000	10,963
May	3,300	7,242
June	3,000	3,677
July	3,600	19,354

(a) Includes metal imported in bond.

Stocks in the hands of dealers and consumers rose from 9,000 flasks in January 1945 to 32,000 in July, exclusive of metal afloat. Consumption declined from 8,500 flasks in June to 6,600 flasks in July.

Radioactive Mineral Land Withdrawn by U.S. Order

President Truman issued an executive order on Sept. 13 withdrawing from sale all public lands containing deposits of radioactive mineral substances. The order also covers such mineral lands "hereafter acquired by the United States."

The President's order follows:

1. Subject to valid existing rights, all public lands of the United States, including Alaska, which contain deposits of radioactive mineral substances, and all deposits of such substances, are hereby withdrawn from sale and all other forms of disposal

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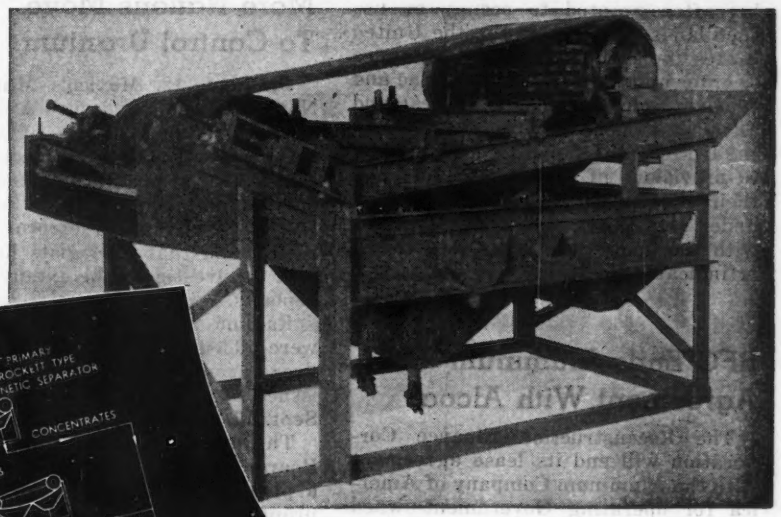

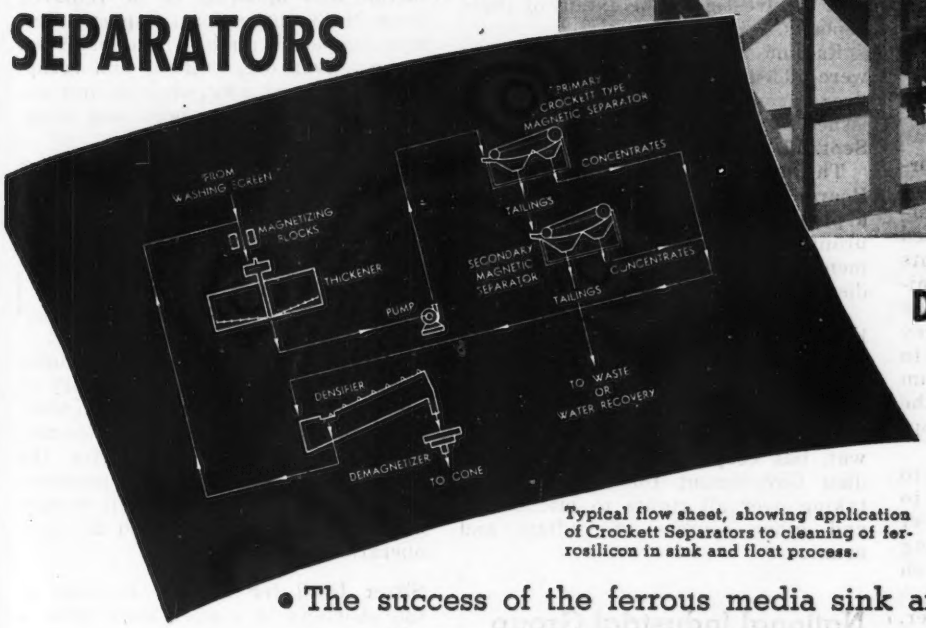

Typical flow sheet, showing application of Crockett Separators to cleaning of ferrosilicon in sink and float process.

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under the public-land laws, including the mining laws, and reserved for use of the United States.

2. So far as not in conflict with existing law, all lands in the United States, its territories or possessions, heretofore acquired by the United States which contain deposits of radioactive mineral substances owned by the United States are hereby reserved from sale, and all leases, licenses, and other authorizations of whatever kind hereafter granted to occupy or use such lands, shall reserve to the United States the right at any and all times to enter upon such lands, and mine and remove such mineral substances; and all such lands hereafter acquired by the United States shall become subject to provisions of this paragraph upon their acquisition; that no reservation under this paragraph shall interfere with the use of the lands established or indicated by any Act of Congress.

RFC Ends Aluminum Agreement With Alcoa

The Reconstruction Finance Corporation will end its lease agreement with the Aluminum Company of America for operating Government-owned alumina and aluminum smelting plants on Oct. 31. The lease is being terminated, RFC said, to free the plants from the agreement, so that they could be disposed of in a manner to create competition in the aluminum industry. The action was taken on the recommendation of the Surplus Property Board.

RFC disclosed that it had offered to make an arrangement for Alcoa to continue operation of any or all of the plants for one year, beginning Sept. 1, but subject to termination on sixty days' notice.

Alcoa replied, in declining the offer, that such a lease would be in fact a sixty-day lease and would leave the company in a difficult operating position.

Reduction plants and related facilities involved in the termination of the agreement are at Jones Mills, Ark.; Los Angeles, Calif.; Massena, N. Y.; Spokane, Wash.; and Troutdale, Ore. Alumina plants involved are at Hurricane Creek, Ark., and Baton Rouge, La.

The plants have a capacity to produce 1,250,000,000 pounds of aluminum and 2,500,000,000 pounds of alumina annually.

U.S. Loan Will Finance Chilean Steel Plant

The Chilean Development Corporation has announced through its New York representative, Roberto Vergara, that the Export-Import Bank of Washington has approved a $28,000,000 credit, which will be used to finance an integrated iron and steel plant at Concepcion, Chile, which will include a 500-ton blast furnace; a coke plant complete with byproduct plant; and mills to produce rails, structural shapes, plate, rods, sheets, tin plate, and electric welded pipe. There will also be adequate steel foundries with equipment for making centrifugal cast-iron pipes. Technical personnel for initial operation and construction will be supplied by the United States.

More Nations Move To Control Uranium

On Sept. 12, Mexico's Ministry of National Economy issued a decree to nationalize all deposits of uranium, actinium, and other radioactive minerals. It is reported that the presence of uranium deposits have been verified in Chihuahua, Guerrero, and Durango, and that geologists have been sent to investigate the extent of these deposits.

Radium and radioactive minerals were added to the items under export license control, according to an order issued by Britain's Board of Trade on Sept. 17.

The Industrial Scientific Research Board, New Delhi, India, has accepted a plan to survey India's resources of uranium and other radioactive elements according to a recent Reuters dispatch.

An undeveloped deposit of pitchblende in northern Saskatchewan, which was discovered in 1935, was examined during the summer by geophysicists who have recently made their report to Ottawa. Saskatchewan has cooperated with the Canadian Government for some time in taking over all rights to pitchblende and other sources of radium and uranium.

National Industrial Group Urges SEC Reforms

A survey of industrial and utilities' executives recently made by the National Industrial Conference Board reveals that Securities and Exchange Commission procedures are considered basically sound but should be simplified. Fear of heavy penalties for omitting some minor detail in preparing prospectuses necessitates tedious, costly and overlong presentation, it was reported.

The following objections were most frequently raised: (1) Too much information is required; (2) the information sometimes required is of such a character that publicity in regard to it would damage the corporation; (3) disclosure of salaries of officers and directors is undesirable; (4) costs of compliance are too great; (5) excessive liability is imposed on directors and officers; (6) too much delay is entailed in completing the financing program; and (7) the SEC attempts unreasonably to regulate corporate business.

The opinion was expressed that because of SEC's stringent requirements, the development of small mining companies is being done largely by well-financed mining companies already in existence and that the "little fellow" is being shut out. It was concluded that "the mine financing business has been overly policed and regulated until only the fearless and well financed attempt to engage in the work."

Import Control Removed On Various Minerals

Import controls were removed from a number of metals and minerals in September. These are materials which are not under allocation and import control of the Combined Raw Materials Board and not subject to public purchase programs. The latest list of metals and minerals to be removed from M-63, the general import order, are: copper, graphite, iron and steel scrap, silver ore, bullion, and scrap, silver products, zinc; chrome ore; corundum; manganese ore; and mica, excluding bookform splittings.

It has been officially stated that a further relaxation of import controls may be expected in the near future.

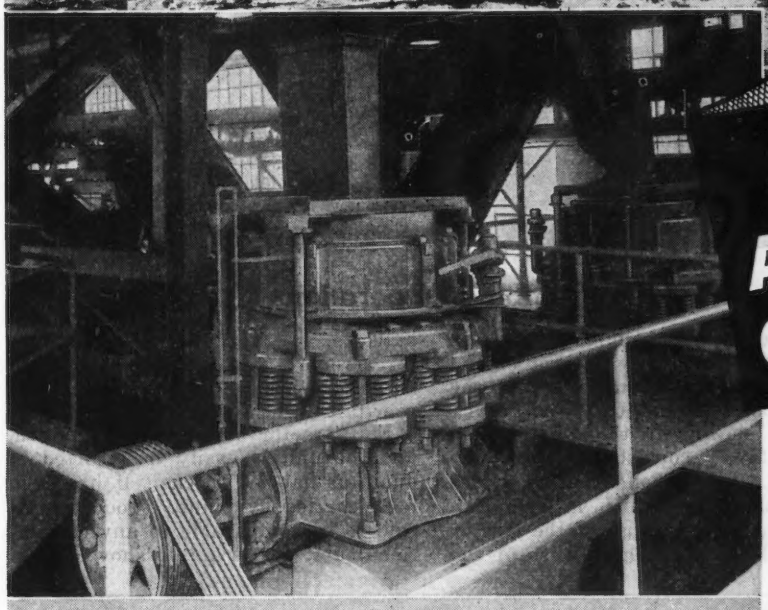
NEWS BRIEFS

Aluminum Plant for Mexico. Reynolds Internacional de Mexico, subsidiary of the Reynolds Metal Co., will soon start construction of a plant to produce aluminum tin and lead foils, for the Mexican and Latin-American markets. The plant, which will be built outside of Mexico City, is expected to start operations next July.

Silver Used for Bombs. Because of the shortage of copper more than a million pounds of silver was borrowed from the U. S. Treasury for use in electromagnet windings at the Oak Ridge plant, in Tennessee.

Sourdough Supper. Nov. 2 and 3 are the dates set for International Mining Day, the annual get-together of mining men of Arizona, Colorado, Mexico, Texas, and New Mexico, which will be held at El Paso, Tex. A colorful Sourdough Supper will climax the event. The El Paso and Carlsbad sections of the A.I.M.E. will participate in the event. Eugene M. Thomas, dean of engineering of the Texas College of Mines, is general chairman.

Sowbelly Dinner. Harvey L. Tedrow, president of the Colorado Mining Association, announces that a Minerals Production and Development Conclave will be held at the Shirley-Savoy Hotel, Denver, Colo., on Jan. 24, 25, and 26, 1946. The world-famous Sowbelly Dinner will be held in the city auditorium. Peacetime production will be high-lighted at conferences, which will attract mining authorities.



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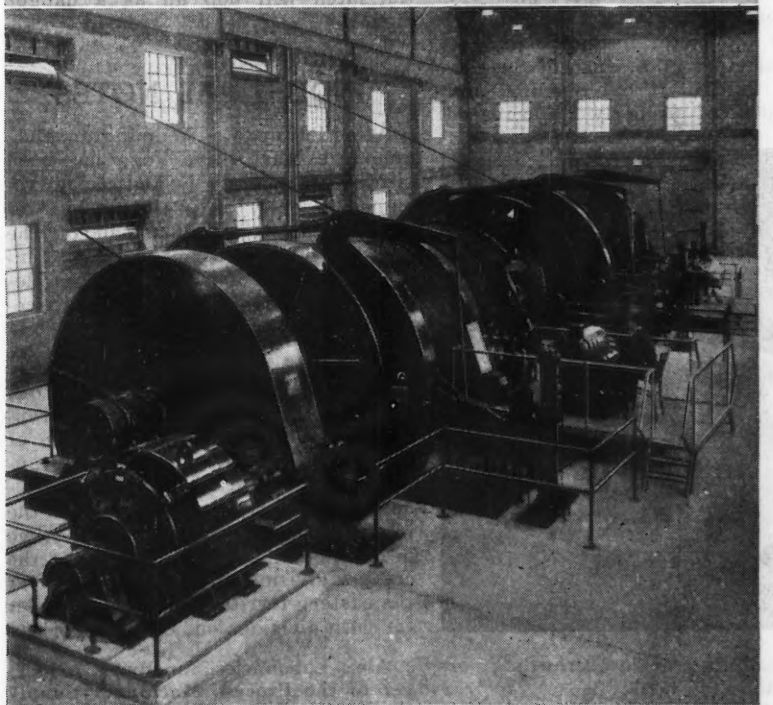
Two 3 foot Symons Short Head Cone Crushers deliver a minus ¼ inch product of iron ore.



The 12 foot diameter single drum hoist in the foreground handles men and materials. Back of this is the 14 foot diameter double drum ore hoist.

The Mount Hope, New Jersey iron property of the Warren Foundry and Pipe Corporation is believed to be America's oldest operating mine. Recently modernized to meet present day demands, here as at so many outstanding mines, Nordberg equipment was selected for the important operations of *Hoisting and Fine Crushing*. Nordberg Hoists and Symons Cone Crushers are a combination which assures of dependable performance and greater production at lower cost. If you have a hoisting or a fine crushing problem, investigate the advantages of Nordberg equipment.

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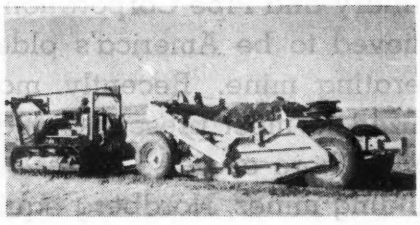
EQUIPMENT NEWS

Two Postwar Scrapers

Among the first of the postwar equipment announcements was that made recently by LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa, which covered two new scrapers now offered by the company. One is a small 2-cu. yd. front-dump scraper; the other is an 8½-cu. yd. cable scraper. Both incorporate many new design features based on the wartime experiences of the company.

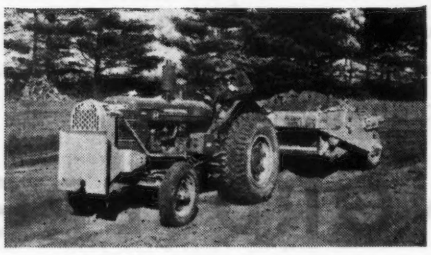
The small scraper, Model CW-2, is the industrial counterpart of airborne scrapers supplied to the Armed Forces for use in clearing roads and airstrips in inaccessible regions. It weighs 2,550 lb. The rear wheels can be located inside or outside the cut, and the scraper can make a full turn within a 20-ft. circle. The hitch is designed for operation behind high-speed industrial tractors such as the International Harvester Model 1-4. Bowl and apron are operated hydraulically.

A new feature of the large scraper (Model C-108) is a floating apron that

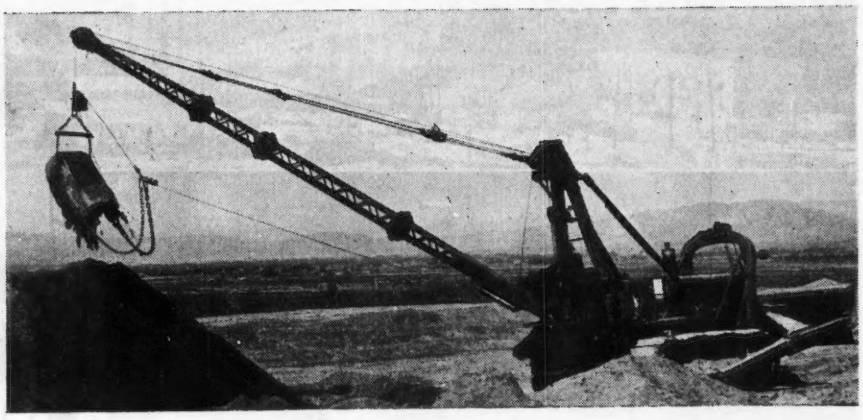


is said to add considerably to performance. The apron opens 30 in. before the rear gate moves, permitting adjustment of the apron to any position before loading. The apron clears the load completely as the rear gate starts forward. The open top bowl permits loading from overhead as well as by scraping, and several other digding and hauling features are described as

Structurally the scraper includes the following features: deep box plate



sections, welded construction, special high-strength but light-weight steel, reversible cutting edge, tapered roller bearings for wheels, and choice of three tire sizes. The scraper weighs 14,500 lb. Further details on both scrapers will be furnished by the manufacturer.



Combined Operations

Practically everything apparently can be done by a new unit called the Hystaway, recently announced by the Hyster Co., Portland, Ore., and Peoria, Ill. As shown in the photograph, the Hystaway consists of a tractor-mounted combination dragline, clamshell, and crane, which in operation still permits partial use of the tractor as a bulldozer. When full use of the bulldozer is required, the manufacturer reports that the crane unit can be detached in less than an hour, and reinstalled in two hours.

Full tractor mobility is retained, and the unit is easily transported in dump or flat-bed trucks. It has even been carried by plane. Production is said to be comparable to any conventional unit for crane or shovel work.

Safety Hook Latch

Thomas Laughlin Co., Portland, Me., offers a newly designed latch for its safety hooks, used for general hoisting and materials handling. The improved latch allows use of 80 percent of the full throat opening, and when operated properly it decreases

the possibility of overcrowding or overloading the hook.

The wider throat opening results from the way the latch assembly when open, straddles the neck of the hook. The load to be hoisted is slipped into the hook, but cannot be removed until the operator releases the latch. If the hook is overcrowded, the latch will not slip into place. If the hook is overloaded, it will spread slightly, and the latch will pop up as a danger signal.

INDUSTRIAL NOTES

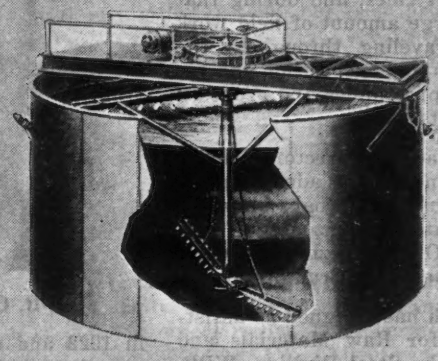
Atlas Powder Co., Wilmington, Del., announces that **Isaac Fogg** has been elected president. **Leland Lyon** resigned recently as president but retains the post of chairman of the board of directors. **F. S. Pollock**, general manager of the explosives department, was also elected a vice-president of the company.

Nordberg Mfg. Co. announces the following changes in its New York office: **A. C. Colby**, for 17 years representative of the crusher division of Nordberg, has resigned to enter another field. **R. R. Shafter**, vice president and general manager of the process machinery division, will serve in addition as eastern manager of the crusher division. **Jack Bond** will cover the eastern territory as sales engineer for both divisions out of New York.

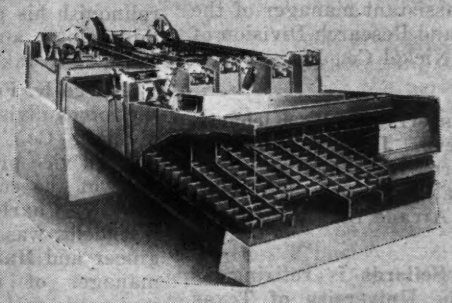
Alex Labounsky announces a merger of the **Process Machinery Supply House** at 50 Broad St., New York, N. Y., which engages in brokerage and supply for export of machinery, materials, and engineering services, with the firm of **Ostrander & Eshleman, Inc.**, New York, N. Y.

ARE YOU READY for GOLD?

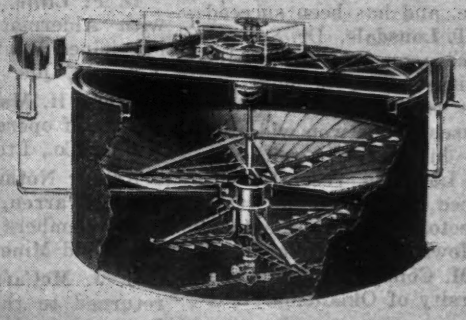
A Modern Cyanidation Plant, one of the last to be built before the war. Equipped throughout with Dorr units—4-Type "A" Agitators, 1-DSFM Classifier, 1-QSF Bowl Classifier and 6-Type "A" Thickeners.



DORR TYPE "A" AGITATOR



DORR CLASSIFIER



DORR BALANCED TRAY THICKENER

Gold mining is staging a come-back, now that the war is ended. After long years of enforced "holiday," most of the wartime restrictions have been lifted. Soon you will be able to put into practice the ideas that you worked out in the laboratory during the period of curtailed production—new ways of reducing tails and cutting costs. You're ready for "gold" with *plans*. Get ready now with new *equipment* to put these plans to work! The Dorr Company offers thirty years experience in wet metallurgy to help you.

Write Dorr about your plans and problems. There have been several improvements made during the war, on Dorr machines. We'll be glad to send you full details about them, or to assist in any other way we can.

556

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PERSONAL NEWS

Lynn Hersey has resigned as general manager of Copper Range Co., Painesdale, Mich., and will return to Arizona to engage in consulting engineering work in the Globe-Miami-Superior mining district. Mr. Hersey left Arizona early in 1942 to go to Washington at the request of the Copper Division of the War Production Board. While there he was chief engineer of the Copper division and later assistant chief, and during that time did a large amount of field work for WPB, traveling throughout the United States and inspecting and reporting on copper mines and proposed copper projects.

Carlos Delgado, ex-director of mines in Caracas and lately administrator of the government's coal mines at Naricual, State of Anzoategui, has joined ARMCO, of Venezuela, as manager of its Puerto La Cruz branch.

H. J. French has resigned as assistant director for Raw Materials and Facilities of the Steel Division, WPB, at Washington, D. C., and has resumed his duties as assistant manager of the Development and Research Division of International Nickel Co., Inc., at New York.

C. H. Lounsberry, R. W. Kieburtz, D. D. Kotschevar, J. Wylie and **L. I. Rake** have formed the mining corporation, Mineral Engineers, Inc., with office at 3143 Arcade Bldg., Seattle 1, Wash.

Dr. E. H. Sellards is retiring as director of the University of Texas Bureau of Economic Geology, after 27 years' service, and has been succeeded by **Dr. J. T. Lonsdale.** Dr. Sellards who will remain on modified service as a university faculty member and will continue to be director of its Memorial Museum, has won wide recognition for his services with the Bureau. Dr. Lonsdale, recently with the Intelligence Branch of the Army, has been director for departments of geology at Iowa State College and Texas A. & M. College and a teacher at the University of Oklahoma.

Jay C. Shoemaker, formerly with Neptune Gold Mines Co. at Bonanza, Nicaragua, has been appointed metallurgist for Ancho-Erie Mining Co., at Nevada City, Calif.

William F. Jenks has been appointed by the State Department to be visiting professor of geology at the Universidad Nacional de San Agustin, Arequipa, Peru.

D. H. McLaughlin has resigned as general manager of Cerro de Pasco Copper Corporation, in Peru, to resume his association with Homestake Mining Co., of which he is president and which is again operating.

Dr. C. O. Swanson has been appointed to the newly created position of chief geologist for the Consolidated Mining & Smelting Co. of Canada, Ltd. Dr. Swanson graduated from the University of British Columbia

DR. C. O. SWANSON

in 1922 and received his doctor's degree in geology from the University of Wisconsin two years later. He will relinquish his position as professor of mineralogy and petrography at the U. B. C. to take up residence in Trail.

George K. Foster, chief engineer of the mines division of Canadian Johns-Manville Co., Ltd., Quebec, was appointed vice president and mine manager of the company's operations on Sept. 7. **Charles Borrar**, mine superintendent, was made chief mining engineer and **Harold S. Deely**, formerly manager of industrial engineering, was made assistant mine manager.

D. F. Lillie, metallurgist, recently with Aldermac Cooper Corporation, has joined Waite Amulet Mines, Ltd., Noranda, Que.

Frank H. MacPherson has assumed charge of operations for Polaris-Taku Mining Co., Ltd., Tulsequah, B. C.

Arthur Notman, of New York, and **G. M. Warren**, of Montreal, have become members of the board of Pioneer Gold Mines of B. C., Ltd.

S. J. McCarroll, metallurgist, has returned to the United States from Peru, where he had been professionally engaged for seven and a half years—first with Mica Mining & Development Co., in charge of milling operations; then as general superintendent for Castrovirreyna Metal Mining Co., and for the past year as superintendent of Eagle Iron Works, at Callao. His present address is 806 Third St., Minot, N. D.

V. V. Clark has returned to the United States after three years' internment in the Philippines. He was prior to the war dean of the College of Engineering, University of the Philippines. His present address is Box 124, Downey, Calif.

Harold A. Waite, formerly engaged in mining engineering in Buenos Aires, Argentine, now is application engineer for Utah, Nevada, Idaho, Colorado, Montana, and Wyoming for Worthington Pump & Machinery Co., Salt Lake City.

E. W. Newman, district engineer for the U. S. Bureau of Mines, resigned recently to accept a position with the American Smelting & Refining Co. He will remain in Montana temporarily, but expects to be assigned to the Salt Lake office of the company in the near future.

Michael Schwarz resigned as director of WPB's copper division, effective Sept. 28.

Burton J. Westman, until recently with the U. S. Bureau of Mines diamond-drilling program in the Iron River district of Michigan has resumed consultation practice at Etna, Siskiyou County, Calif.

J. B. Clemmer, of Tuscaloosa, Ala., has been appointed chief of the Tucson division of the metallurgical branch of the U. S. Bureau of Mines at Tucson, Ariz.

A. C. Dundas has resigned his position as mill superintendent of the Darwin Mines, of Darwin City, N. M., and has joined the staff of the U. S. Smelting, Refining & Mining Co. at Bayard, N. M.

Fred W. Denton, superintendent of mines of the Copper Range Co., Painesdale, Mich., has been made general manager of the company's copper mining division, succeeding **Lynn Hersey**, who has resumed consultation practice.

Mack C. Lake, vice president, Manganese Ore Co., subsidiary of M. A. Hanna Co., of Cleveland, Ohio, has left San Francisco for Venezuela, S. A., on professional business.

E. C. J. Meyer, general manager of the New Modderfontein Gold Mining Co., is retiring after 38 years' service with the Central Mining Rand Mines group, 33 years of which have been in a managerial capacity.

C. C. Starr has opened an office as a consulting mining engineer at 720 Pacific Bldg., Vancouver, B. C.

E. H. Anderson has been advanced from assistant superintendent of Tobin-Columbia mine of Republic Steel Corporation, at Crystal Falls, Mich., to superintendent at that property.

Charles Lovaas has been appointed superintendent of Schley iron mine of North Range Mining Co. at Gilbert, Minn.

H. Mortimer-Lamb has retired as secretary of the Mining Association of British Columbia, an office he has

neld since its inception. He has been succeeded by **E. V. Ablett.**

Harvey Seeley Mudd, national president of the A.I.M.E., was the guest and principal speaker at a meeting of the Nevada section of the Institute held at Ely on Sept. 8.

M. Wallace Woolley, member for 37 years of the ore purchasing department of the U. S. Smelting, Refining & Mining Co., has been in Nevada districts in connection with mine operating activities with which he has become associated, having lately resigned his position with the smelting company.

J. R. Van Fleet, president of the U. S. Vanadium Corporation, recently visited tungsten properties in the Potosi district of Nevada, accompanied by **Blair Burwell,** vice president and manager; **M. N. Shaw,** in charge of the company's great Pine Creek project near Bishop, Calif., and **Clarence Hall,** field engineer.

F. H. Hayes has been made deputy vice chairman for Metals and Minerals of the WPB, succeeding **James Douglas,** who recently resigned. Mr. Hayes is succeeded by **David L. Foster.**

George A. Bell, chemical and metallurgical engineer, who recently returned from the Philippines after 37 months' imprisonment by the Japanese, has joined the staff of the New Cornelia branch of Phelps Dodge Corporation at Ajo, Ariz.

W. F. P. McLintock, who had been deputy director of the Geological Survey and Museum (Great Britain) since 1937, has recently appointed a director of the Geological Survey of Great Britain and Museum of Practical Geology.

M. A. Mawby has become director of development and research for Broken Hill Associated Smelters, at Melbourne, Australia.

O. Tichauer has been made general superintendent of the lead-zinc-copper plant of the Comara Mining & Milling Co., Ltd., at Ferguson, B. C.

P. B. Everest has been made mine superintendent for Lamaque Mining Co. at Bourlamaque, Que.

Robert Forsyth recently left British Columbia for the Cuyuni Goldfields property, in British Guiana, where he will join the staff of the company as mechanical and construction engineer.

Dr. S. E. Madigan has been made director of British Columbia Industrial and Scientific Council, Vancouver, B. C. He succeeds Dr. G. M. Shrum, head of the department of physics at the University of British Columbia.

Robert Bremner has been transferred by Pickards, Mather & Co. from the company's engineering department at Newport Iron Mine, at Ironwood, Mich., to its Cary Mine, Hurley, Wis., where he will be assistant mining captain.

Raymond Boedus, recently on the staff of Aldermac Copper Corporation, at Sherbrooke, Que., has joined the French Supply Council, at Washington, D. C., as chemical agent.

Philip D. Wilson, assistant to the president of Baker & Co., and formerly vice chairman for Metals and Minerals of the WPB, was recently elected a director of Baker & Co., Inc.

Luis Urruticaechea, president of Astoreca & Urruticocechea, Chilean nitrate miners, recently arrived in the United States on the "Chile Clipper" of Pan American World Airways. He will spend six months in Washington and New York, where he will consult with engineers and industrialists in the interest of his company.

H. F. Kannady has been appointed contact engineer at the Copper Queen branch of the Phelps Dodge Corporation.

Alex G. Ballachey, former general manager of Base Metals Mining Corporation, Ltd., has been appointed general manager of Quemont Mining Corporation, Ltd.

Roberto Tapia T. has been appointed chief of the metallurgical laboratory in the smelting department of Cia Constructora de Maquinaria, in Mexico City.

E. L. Bemis, chief engineer of mines of Wisconsin Steel Mines on the Mesabi Range, has been made general superintendent of mines.

Dr. Arthur Fleischer, former technical director of Kalunite, Inc., Salt Lake City operator of the DPC alunite-alumina processing plant, is making an extended scientific tour of New England, mid-Atlantic and southern states before returning to the West.

Clarence W. Hoffer has recently received a promotion from Lieutenant commander to commander, and is an executive officer at a large naval station overseas. He may be reached care Navy 1995, Box 11, Fleet Post Office, New York, N. Y.

Carl O. Lindberg, consulting engineer to the Goldfields American Development Co. of New York and member of the New Consolidated Goldfields Committee in the U. S. A., was recently in London in connection with these companies' interests in Latin America.

G. Goldthorp Hay, president of The Yukon Consolidated Gold Corporation, Ltd., has come to Canada for the first time since the outbreak of war. Following a meeting of directors in Toronto, he will proceed to Vancouver and, possibly, the Yukon Territory.

Dr. W. T. Griffiths, for many years head of the department of research and evelopment of the Mond Nickel Co. Ltd., (International Nickel Co. of Canada) has been made chairman of the company and its affiliated interests, succeeding **D. Owen Evans,** deceased.

M. N. Shaw has been promoted to general superintendent of the Western Tungsten Division of the United States Vanadium Corporation. **Arch F. Boyd** succeeds Mr. Shaw as Superintendent of the Pine Creek Tungsten unit, at Bishop, Calif. **R. G. Sullivan,** who has been in charge of the tunnel operations at the Bishop plant, has been named assistant superintendent and **H. R. Downing** has been named mill superintendent, succeeding **J. V. Galloway,** who has been promoted to superintendent of the corporation's new tungsten property near Winnemucca, Nev. **W. R. Jones** is mine superintendent at the Pine Creek mine.

Corrections

In the article on Canaea Consolidated Copper Co., *E.&M.J.* September 1945, the primary crusher was inadvertently referred to as an Allis-Chalmers crusher. The unit is actually a 54-in. gyratory manufactured by the Traylor Engineering & Manufacturing Co., Allentown, Pa., as was correctly stated in the article on Cananea in *E.&M.J.* December 1944.

Hewitt S. West, president of Tungsten Mining Corporation, Henderson, N. C., advises that the personal published in the September *E.&M.J.* stating that **H. H. Bradt** had been made managing engineer of the company and **Edmund Newton,** mine manager, was absolutely wrong. Mr. West says that the Tungsten Mining Corporation is under his direct management and that **James I. Moore, Jr.,** is general superintendent in charge of all operations of the tungsten property in North Carolina, which is under development and where a 200-ton gravity and flotation plant is being installed. There is no such position as managing engineer, although **E. H. Emerson** is engaged as consulting engineer. In addition to the officials already named, the executive and operating personnel include the following: **W. L. Long,** vice president and general counsel; **H. V. Door,** secretary and treasurer; **D. B. Gregg,** mill superintendent.

Solomon Le Fevre

An Appreciation by Alvin M. Cummings

Solomon Le Fevre, an outstanding expert in magnetic separation and in the magnetite mining industry, is gone. We all know of his fine character, modesty, and accomplishments, but it was the privilege of only a few to know his devoted friendship. He died peacefully in his sleep at his home on June 7 at the age of 83.

He was born in Forrest Glen, New Paltz, N. Y., and descended from the

original "Patentees," who settled New Paltz. He was a graduate in civil engineering at Rutgers College, class of 1882. His mining engineering career began with the Hudson River Ore & Iron Co., Burden, N. Y., as assistant engineer on construction of a railroad, shops, power plant, mine equipment, and roasting kilns. Following the completion of construction work, he was made paymaster and accountant. As an accountant, he devised a system of itemized cost accounts. Later, he was made mine superintendent and assistant general manager. The Burden company mined and roasted about 200,000 tons of iron carbonate per year.

Mr. LeFevre's advance was rapid. He became assistant engineer of the New York State Land Survey and chief engineer of the Chateaugay Railroad Co.; later, assistant general manager of the Chateaugay Railroad Co. and the Chateaugay Ore & Iron Co. The function of both companies was to mine the large low-phosphorus magnetic iron ore deposit at Lyon Mountain, New York.

As general manager of the Arnold Mining Co., at Arnold, N. Y., he was responsible for the success of the Ball Norton magnetic separator and the reopening of an old magnetite mine, and the constructing of a magnetic concentrating mill, a railroad, and a town. His last official position was general manager of Witherbee Sherman & Co. at Mineville, N. Y. Under his management, an extensive program of exploration of mineral lands, mines development, and construction of magnetic concentrating mills was carried to a successful completion. At the close of the first World War, he had to his credit a successfully planned program which contributed the largest production of magnetic iron ore concentrates from any single property in the United States. The production trebled any previous record and at amazingly low costs. The Witherbee Sherman mills and mines were considered models of their kind.

Following the first World War the surplus of Lake Superior hematite ores and the low cost of Lake transportation were responsible for curtailing production from all Eastern mines and resulted in the closing of many. The retrenchment at Witherbee Sherman company included the appointment of a large stockholder of the company to succeed Mr. LeFevre as general manager.

After the completion of his official work with Witherbee Sherman company, Mr. LeFevre returned to his old home at Forrest Glen and became a consulting mining engineer. He was consulting engineer for the designing of magnetic concentrating mills at Lyon Mountain, Mineville, Sterling, Forrest of Dean, and Benson mines, in New York, and at Ringwood and Mount Hope, in New Jersey. Up until about a month before his death, he was active as a land surveyor.

A Letter Urging the Need for a Progressive National Mining Policy

Donald Callahan, Noted Mining Leader, Calls Senator Murray's Attention to Urgent Necessity for Overhauling Present Practices—Indorses E.&M.J. Recommendations as Presented in April Issue

Honorable James E. Murray,
Senate Office Building,
Washington, D. C.
My dear Senator Murray:

You will recall that, during the hearings at Helena recently, you asked me to write you a letter stating my views relative to a postwar policy aimed at promoting the mining industry as it related to small mining enterprises.

I do not propose in this letter to undertake more than an outline of a mineral policy. It is too large a subject to be covered in this letter. I shall confine myself to what I consider pressing needs for most of the high-cost and marginal properties which were brought into production because of the urgency of the demand for war metals. I shall also, if I may, offer a suggestion as to a course to be pursued by Congress for the purpose of arriving at a mineral policy during the years that lie ahead.

As to a policy with regard to the immediate situation of high-cost and marginal mining properties: I quite agree with the thesis of Mr. Robinson, advanced at Helena, that premium prices should be continued, but not indefinitely. I do not feel that the Government necessarily owes it to high-cost producers that they shall make a profit from their enterprises regardless of other considerations. I am opposed to subsidizing the mining industry. Such a policy would mean Government control and, in my opinion, would hamper and not promote the reduction of minerals. There are certain conditions under which, in my opinion, such a program should be followed. They are:

1. As a measure of justice towards companies which incurred capital expenditures or underwent extensive development in order to furnish critical metals needed for the war. In this case, I believe such companies should be considered by the payment of premium prices until they have been made whole. The metal derived from such operations should be stockpiled so as not to break down the market for other metals. The alternative to this would be lump-sum settlements which perhaps would be extremely difficult to arrive at.

2. Many mining companies, because of the urgency of production of critical metals for the war effort, have seriously delayed programs of development which should have been carried out in the interest of economical mining. Such companies should have a continuance of premiums until their properties have been properly developed for efficient operation.

3. The importance of furnishing employment to labor after the war demands that operations which can only be carried on through continuation of premium payments must not be lost sight of. Full employment of our miners must be continued, as Mr. Robinson has stressed in his statement before your committee.

You have asked me as to the maintenance of tariffs. I firmly believe that tariffs should be maintained to prevent the low-cost metals of other countries from competing unfairly with the metal producers in the United States. Compared with many other countries, our non-ferrous metal production is most costly. This is due to two facts:

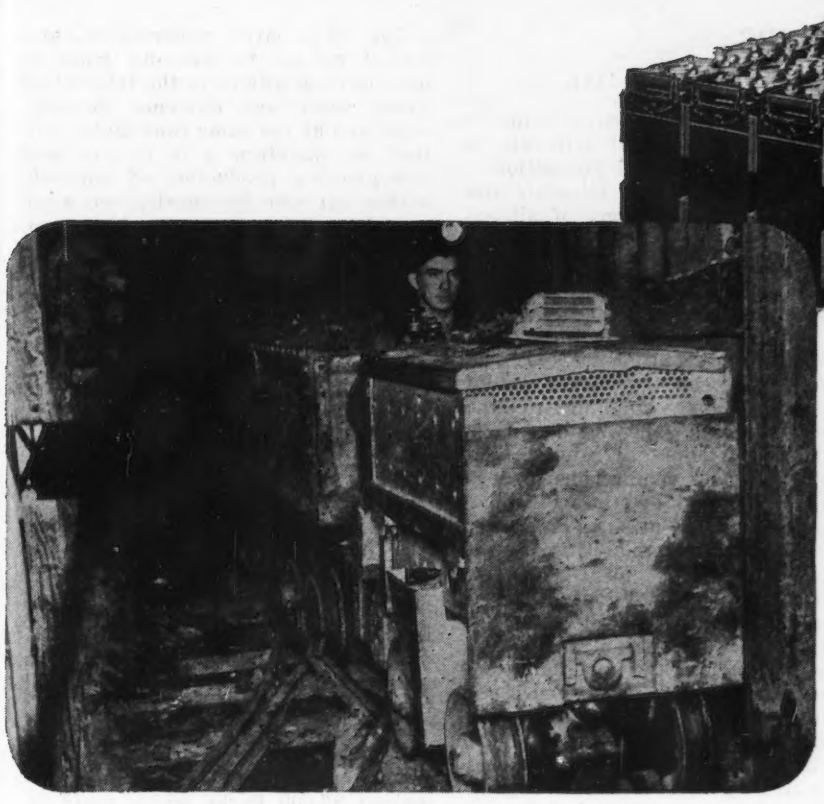
1. That the ore deposits in many sections of the world are much richer than those found here.

2. Labor and materials used in the production of our ores are much more costly.

I do not favor a tariff which would exclude the metals of other countries entirely, but I do not believe that we should enter into trade agreements reducing the tariff rates on metals imported from one country and thereby extend the same privilege to low-cost producers in countries which are not parties to the agreement and give nothing in exchange. A tariff which equalizes the cost of production here and abroad should not arouse antagonisms among other nations. Remember the principal difference in cost is brought about by higher wages paid to our miners, a condition which labor especially should be most anxious to maintain.

The problem of an international mineral policy, however, is much broader than that covered in the investigation which your committee is now making. In providing for such policy, we cannot ignore the future of the low-cost metal producers, but must seek to adopt a program which will result not only in providing for our national metal requirements, but will enable our nation to take its proper place in world commerce and provide as well for a continuing metal supply. I do not feel that we have reached the point where we are a have-not nation with respect to metals. Experience during the war and the results achieved by the prospecting program of the Bureau of Mines have demonstrated that we have vast untouched mineral resources. To properly explore and develop them, however, will require a policy which will enable both low-cost and high-cost

(*Continued on page* 116)



IT'S THE TONNAGE THEY DELIVER THAT COUNTS

In Mine Locomotives and Shuttle Cars Alkaline Batteries Give You These Important Advantages

- They are **durable mechanically;** grids, containers and other structural parts of the cells are of steel; the alkaline electrolyte is a preservative of steel.
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- They **withstand temperature extremes;** are free from freezing hazard; are easily ventilated for rapid cooling.
- They can **stand idle indefinitely** without injury. Merely discharge, short-circuit, and store in a clean, dry place.
- They are **simple and easy to maintain.**

Keeping maximum production of coal or ore coming out puts a premium on availability of underground haulage and tramming equipment.

Time and experience have demonstrated that the unequaled dependability of Edison alkaline batteries gives the closest approach to failure-free, uninterrupted haulage it is possible to obtain. They stay on the job and out of the repair shop . . . give longer service life than any other type of battery. In fact, alkaline batteries that have been "worn out" in locomotive or shuttle-car service, are often used for various kinds of lighter duty standby work for which their capacity is still ample, and there deliver more years of dependable service.

Because they give such long, trouble-free life and are so simple to maintain, alkaline batteries also help keep down haulage costs. *Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, N. J.*

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Direct ventilation prevents lens fogging. Eye cups are transparent for clear side perception. Accurately fitted to facial contours. Leather nose bridge adds extra security.
Willson Cover-All* cup goggles give complete protection on eye-hazardous operations. Roomy enough to fit over ordinary correction spectacles.
LOW COST Eye Safety For Spectacle Wearers

LETTERS

(*Continued from page* 114)

properties to expend large sums in bringing new stores of minerals to the point of economical production.

We all realize that minerals are necessary to the economy of all nations, but are not equally distributed and controlled. It is inevitable, therefore, that minerals will enter into world economy as well as into military and political movements throughout the world. The continuance of world peace will depend to a large extent upon the proper handling of the world's minerals. We are not in a position to participate in international affairs without a comprehensive, logical mineral policy of our own.

In the framing of such a policy, operators, labor, and Government must participate. While I recognize the necessity of any international mineral policy being handled through national and international agencies, I do not believe that the experience and wisdom of those who developed our metal production to its present point should be ignored. I feel that we must have a program in which all branches of our mineral industry, labor organizations connected with such industry, and the Government, which has such a tremendous stake in a proper mineral policy, should cooperate and work out a program which will enlist the full-hearted support of all who have an interest in the production, fabrication, and distribution of metals and minerals.

May I, therefore, respectfully recommend to you, as the representative of one of the greatest mineral producing states of this nation, that you and your committee take the lead in a thoroughgoing examination of all the factors to be considered and the development of a mineral policy which will be in the interest of the entire nation.

I feel that you should urge upon Congress such an investigation as will develop all of the factors to which I have made reference, and that in such investigation you will consider the following, which are suggested in a very thoughtful discussion of this problem in the *Engineering and Mining Journal* of April, 1945. The editor of this magazine, Mr. Evan Just, suggests a national mineral policy which should include:

1. Tax policies that encourage exploration and development.
2. Conservation through efficiency and maximum use.
3. A logical balance between domestic production and imports.
4. Modernization of protection for domestic industry.
5. Stockpiles for security and as economic cushions.
6. Enlightened participation in mineral cartel activities.
7. Improved Government service to American operations abroad.
8. A public land policy that fosters development.

This is a large undertaking, and yet, if we are to take our place in international affairs in the interest of world peace and economic development and at the same time make sure that we maintain a continuous and ever-growing production of minerals within our own boundaries, we must consider all elements involved and, through the wisest counsel based upon experience, formulate a national mineral policy which will go far toward the preservation of peace and the raising of economic standards throughout the world.

Thanking you for the opportunity of expressing the opinions herein contained, I am, Very truly yours,

DONALD A. CALLAHAN.

Wallace, Idaho, Aug. 31, 1945.

More on Quicksilver

The Editor:

In connection with Mr. Pehrson's letter upholding his prediction of 97 percent exhaustion of quicksilver in the United States, it might be well to add some little information.

Since Mr. Pehrson said his data were based on Mr. Edwin C. Eckel's report of early 1944 that there remained 86,000 flasks which could be produced at $100 a flask, we wonder why Mr. Pehrson should give this as valid in early 1945. All of us in the quicksilver industry are familiar with Mr. Eckel, and we realize that the bulk of his information was collected in 1942 and 1943 and that he was transferred by the Survey to other problems early in 1944.

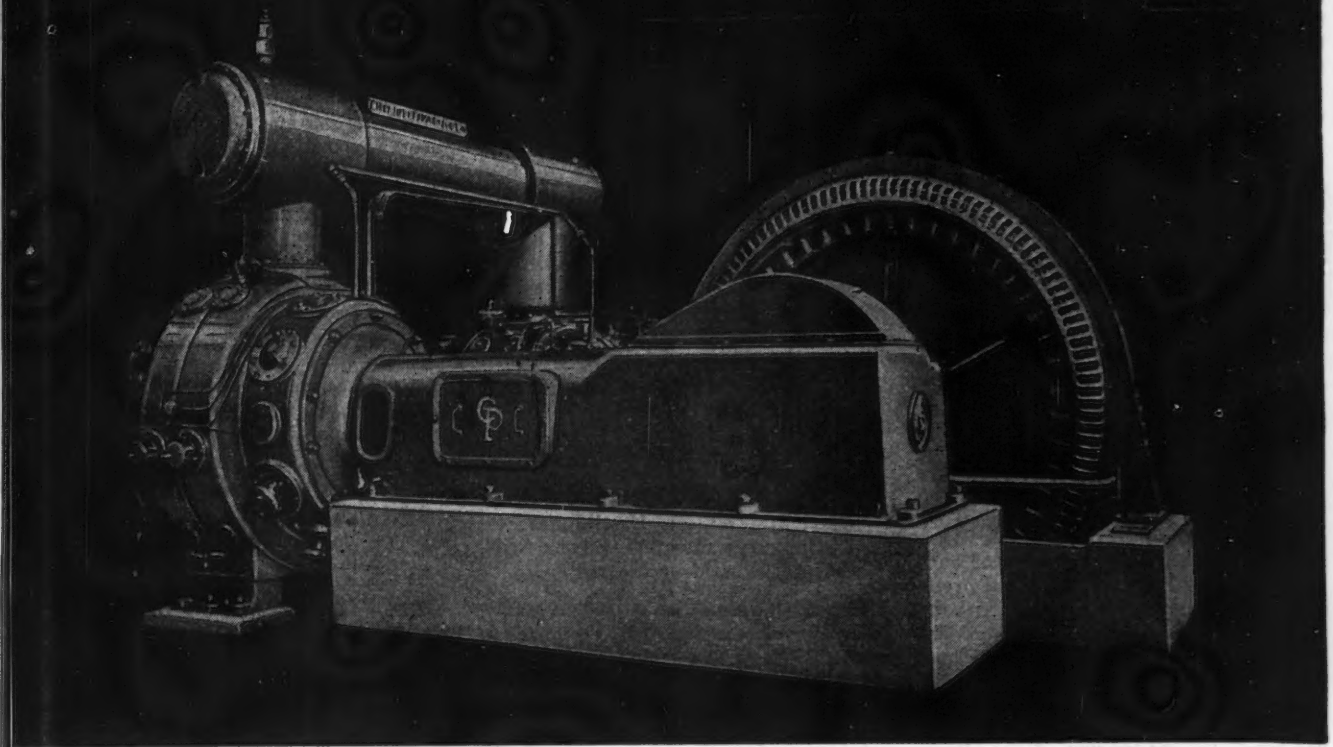
In so far as many of the mines are concerned which were examined by Mr. Eckel and the men under him, the information in his reports must have been almost a year old when the report was made. Thus Mr. Pehrson's prediction of 97 percent exhaustion made in February 1945 was based on information some of which was almost two years old. Information two years old in the quicksilver industry would ignore the existence of the two principal producers during the year 1945.

For Mr. Pehrson's information, the 75,000 flasks mentioned in my letter could be produced for less than $100 per flask, on prewar costs. Whether they could be produced at that on postwar costs without tariff protection is a different matter, but the same question arises as to all American mining. If costs are to be doubled and tariff protection is to be removed, no mining industry can see much of a future.

I think the basic criticism to be made of estimates of reserves is a fairly simple one. Any estimate which places known reserves against previous production is bound to be erroneous, since it gives no credit for aditional discoveries. The proper comparison should be a comparison of known reserves as of one date with known reserves as of a later date.

(*Continued on page* 156)

Low Power Consumption



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NEW BOOKS

MINERALS YEARBOOK, 1943. U. S. Bureau of Mines. For sale only by Superintendent of Documents, Government Printing Office, Washington 25, D. C. Price $2.50.

Relaxation of security regulations permits the public release of this heretofore confidential 1943 volume on the production, distribution, and consumption of mineral commodities. It contains separate chapters reviewing all known minerals in daily use—metallic, non-metallic or industrial, and fuels. There is also a section on international aspects of war mineral procurement, and a statistical summary of mineral production making current for the first time since 1931 the detailed output by states. Sections in the various chapters cover the postwar outlook on all but a few of the minerals treated, and a number of new charts are presented.

INDUSTRIAL RESOURCES OF TENNESSEE. Compiled by George I. Whitlatch, Industrial Development Division, Tennessee State Planning Commission. Pp. 210. Price $1.

One of this volume's eleven divisions, comprising 35 pages, is devoted to mineral resources. In value of output the State's principal mineral products combined to give a total of about $44,000,000 in 1940, with coal at the top of the list at $12,000,000. Phosphate rock stood fourth, with approximately $4,000,000. Sulphuric acid and copper, together, yielded about $4,219,000, zinc $2,000,000, ferro-alloys $1,500,000, pig iron $526,000, clays $471,000, barite $408,000, and manganese ore $120,000. Cement, crushed ore, clay products, sand and gravel, marble, lime, and coke and its by-products made up most of the remainder. The book closes with a summary of taxes.

YEAR BOOK OF THE AMERICAN BUREAU OF METAL STATISTICS, 1944. W. R. Ingalls, Director. 33 Rector St., New York, N. Y. Pp. 112. Price $2.

Although restrictions on publication of nonferrous metal statistics are not yet wholly relaxed, they have been sufficiently rescinded to permit the 24th annual issue of this standard reference work to offer a more comprehensive survey of data than was possible a year ago. Import and export statistics for 1943 and 1944 are not released, and the production of tin is not wholly clear. Of course, nothing is known of production and consumption in the Axis countries and those dominated by them. Nevertheless, new data have been revealed on hitherto unknown production and consumption, through the activities of the Bureau of Mines, War Production Board, and Bureau of the Census. Dr. Ingalls discusses the details of these and other matters in an introductory note that should be read by all who use the Year Book and rely upon it for its customary information on copper, lead, zinc, gold and silver, and miscellaneous metals.

MINING DIRECTORY OF MINNESOTA, 1945. By Henry H. Wade. Mines Experiment Station, Minneapolis, Minn. Pp. 234. Price $1.

The most-used book in the Minnesota Iron Country is this annual handbook, which is far more than a "directory." Most of the questions that arise regarding individual properties, companies, personnel, affiliates, fees and leases, production, taxes and the like can be answered from the data it contains, if one knows where and how to look for the answers. Northern Michigan—the mining area of that State—needs a similar reference book.

MINING YEAR BOOK, 1945. Published by Walter E. Skinner, 20 Copthall Ave., London, E.C.2. Price 26s, net. Post free abroad.

The 59th annual issue of this standard reference work contains complete and up-to-date information about 811 mining companies operating in all parts of the world, together with a list of names and addresses of 873 mining engineers and managers connected with the companies mentioned in the book. Changes that have occurred during the past year are recorded. Other features are maps and plans of various properties, statistical tables of gold production in the principal mining fields, and a supplementary list of companies that have been mentioned in previous volumes.

CONDENSED MINING HANDBOOK OF UTAH. By Robert S. Lewis. Bulletin 29, Department of Mining and Metallurgical Research, University of Utah, Salt Lake City. Pp. 130. Price $1.

This new handbook fills a real need with respect to Utah mines. Following a nine-page summary of mining in the State in 1944, six pages of which are devoted to a tabulation of mineral production, the book is given over to a mining directory which includes all metal, non-metal, and coal mines in the State. In each case, the company name, address, capitalization, and officers are given. Additional information as to holdings and equipment is furnished in some cases.

PIPING HANDBOOK. Fourth Edition. By Sabin Crocker. McGraw-Hill Book Co., 330 West 42d St., New York 18, N. Y.

Principal changes in the new edition consist of the addition of chapters on "Gas Piping," "Refrigeration Piping," "Hydraulic Power Transmission Piping," and "Corrosion," the last also dealing with protective coatings. Another chapter, on "Water Supply Piping," has been much enlarged, and additional material included in the section on "Flow of Water in Pipes." All existing codes, dimensional standards, and materials specifications have been revised.

PUBLICATIONS RECEIVED

"Collective Bargaining." By John W. Scoville. For free copies write Newspaper Statistical Service, Lafayette Building, Detroit 26, Mich.

"Recent Mining Practices in Tri-State District. A Comparative Analysis." Bulletin School of Mines and Metallurgy, Rolla, Mo. Pp. 64.

"A Guide for Prospectors in Manitoba." Third edition. Last previous edition was in 1937. Save for occasional additions and minor changes in text and differences in photographs used for illustration, the third edition is largely the same as the second. Pp. 118. Address all inquiries to The Director of Mines (George E. Cole), Winnipeg, Man., Canada.

"The Western Steel Industry—With Special Reference to the Postwar Operation of the Geneva Steel Plant." Parts I and II. Published by Bureau of Economic and Business Research, University of Utah, Salt Lake City. Pp. 73 and 54 respectively.

"War Plants Disposal: Iron and Steel Plants." Second Progress Report on Preparation of Joint Hearings to Be Held by War Contracts Subcommittee of the Committee on Military Affairs. Pp. 25, plus charts. Washington, D. C.

The following Information Circulars and Reports of Investigations have been issued by U. S. Bureau of Mines, Washington, D. C. No charge is made.

I.C. 7320. Trends in Consumption and Prices of Chemical Raw Materials and Fertilizers. Pp. 27.

I.C. 7325. Testing Safety Catches on Mine Cages, Lake Superior District. Pp. 12.

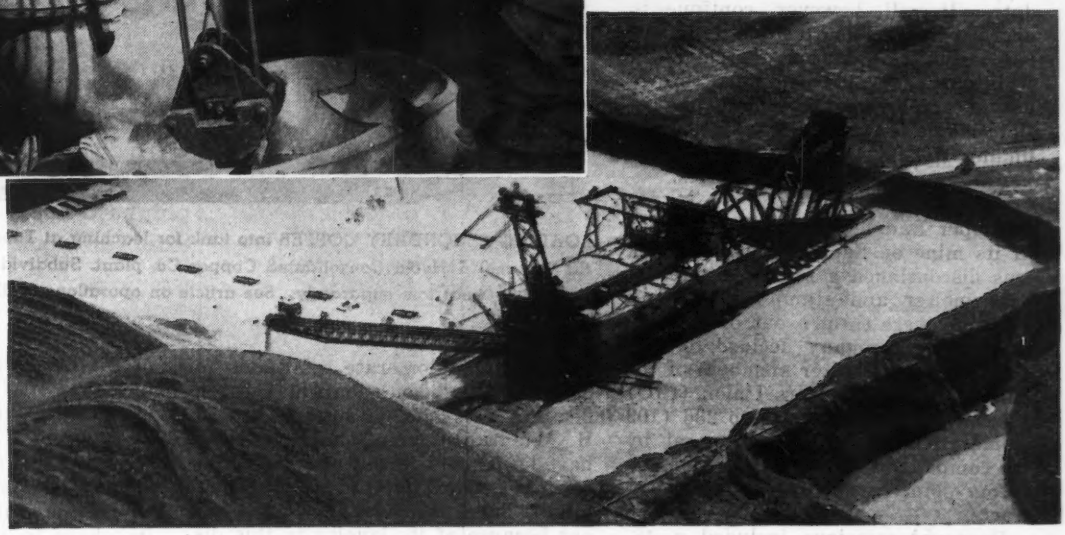
R.I. 3806. Studies in Redistillation of Carbothermic Magnesium. Pp. 53.

R.I. 3810. Magnetic Survey of the Florida Peninsula. Pp. 49.

BUCKET PINS – by YUBA

Left: Changing bucket pins on YCGF Dredge No. 20.

Below: Yuba Consolidated Gold Fields Dredge No. 20, Hammonton, California.



It's time for a change, on a placer mining dredge, when bucket pins are worn to a point where the metal remaining in the pin body is dangerously thin. A badly worn pin becomes a threat of lost time. Lost operating time due to broken bucket pins, perhaps with a bucket line dropped in the pond, can be avoided by using only pins made from tested steels carefully forged, machined and heat treated.

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REGIONAL NEWS

MICHIGAN

Termination of cost-plus agreements shuts down Quincy mine—Copper Range suspends operations, work offer rejected.

★The special price or cost-plus agreements which the Copper Range, Quincy, and Isle Royale companies had with the Federal Government were terminated Sept. 1, and, as a result, the Quincy mine was closed on that date. It will, however, continue to operate its reclamation plant on the old tailings at Mason, Torch Lake. Approximately 500 men were thrown out of employment through this action, but it is stated the majority are finding work with other mining companies or in the woods industries.

★Copper Range suspended operations at its mine on Sept. 20, and all work was discontinued a few days later at the smelter and stamp mill. About 700 men were thrown out of employment. The company decided to suspend operationh after members of the United Copper Workers Union (CIO) rejected by a vote of 245 to 236 (199 members not voting) a proposal by the company to continue operations on a four-point revision of existing contracts.

Proposed revisions included a 48-hr. week on a two-shift basis, slight reduction in the number of surface workers, 40-hr. week for surface workers, cancelation of shift differentials, and cancelation of vacations with pay. All adjustments were to remain in effect until previous benefits could be restored. Wage rates classifications were to remain.

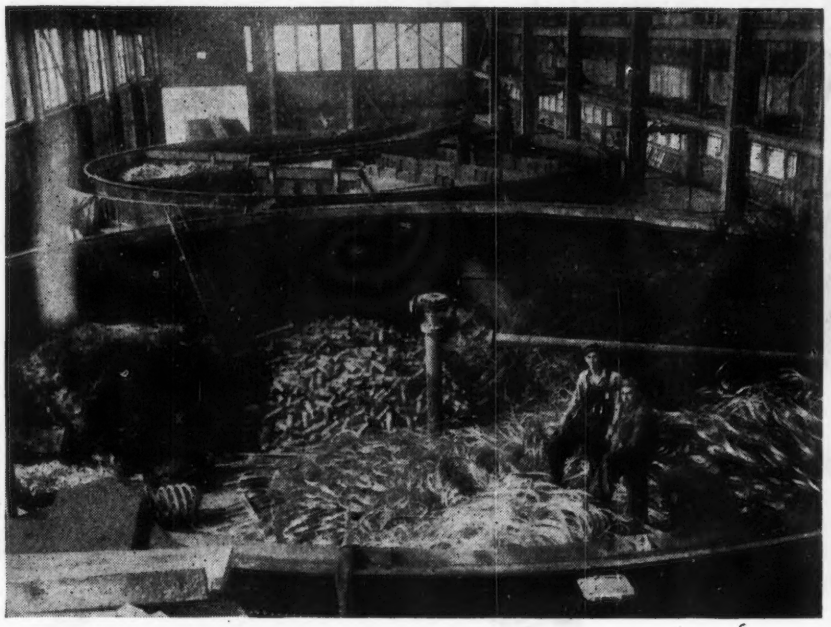
★Calumet & Hecla is operating on a premium price plan and is not affected by the termination of the special price or cost-plus agreements. The premium price was established to encourage additional production by companies whose cost of production was in excess of the established 12c. per pound. Should the plan be terminated before the extension date of July 1, 1946, Calumet & Hecla would be able to carry on its operations without loss only if the demand for copper warranted a sufficiently high price level at that time.

★To perpetuate the mining industry in this district, Calumet & Hecla has carried on a comprehensive exploratory campaign for a period of 25 years in the hope of finding other commercial lodes to replace the once famous Calumet conglomerate. Millions of dollars have been spent in this endeavor. This money, according to A. H. Wohlrab, general manager, could have been spent in ventures in Canada or other unexplored districts which might have had brighter prospects, but because of its loyalty to this district, Calumet & Hecla has consistently adhered to the policy of conducting most of its exploratory work in the "Copper Country."

"Realizing that it was becoming increasingly difficult to continue profitable mining operations because of the low grade of Michigan copper ores, as compared with the grade in other districts," said Mr. Wohlrab, "the company entered the manufacture of copper products in the hope that although no profit might be obtained in mining copper, a sufficient profit could be obtained from the finished product to permit the continuance of mining operations in this district. With this in view, the Wolverine Tube Co. in Detroit, was acquired. Because of the encouraging results from this enterprise, as well as the successful venture into the field of secondary-copper treatment, plans are being made to enter more extensively into the manufacture, in this district, of various chemical copper products."

★With some of the secrecy unveiled in the development of the atomic bomb, it can now be revealed that copper taken from Calumet & Hecla mines aided greatly in the completion of the most devastating weapon used in World War II. This announcement came in a War Department release, as follows:

"That the Calumet & Hecla Consolidated Copper Co., through the Wolverine Tube division, contributed its share in the development of the atomic bomb has not been generally known. It can be told, however, that the raw material from the company's mines and fabricated by the Wolverine Tube division played an important part in the manufacture of the devastating bomb that brought Japan to her knees."



LOADING SECONDARY COPPER into tank for leaching at Tamarack reclamation plant of the Calumet & Hecla Consolidated Copper Co. plant. Subdivided tank in the background is used to treat lots separately. See article on operations p. 89.

ILLINOIS and KENTUCKY

Fluorspar producers return to 40-hr. week—Mahoning Mining Co. starts Mineral Ridge operations south of Salem

★Martin Schwerin, of Tucson, Ariz., has purchased the Victory Fluorspar Mining Co., which is situated about ten miles east of Rosiclare, Ill. The company was formerly owned by C. M. Barnett, Jr., Addison Outwater, and Martin Schwerin. Mr. Schwerin purchased the interest of his two partners in the latter part of August. The amount of the transaction as re-

corded by the deed to the property was $106,000, or $53,000 to each of his two partners.

★Because of the cancellation of orders for fluorspar by a number of hydrofluoric acid plants and the reduction of orders by other war industries, it has become necessary to curtail fluorspar production. Therefore, some of the major producing companies in the Illinois-Kentucky district returned to a 40-hr. week beginning around the first of September.

★The Mahoning Mining Co., of Rosiclare, Ill., has begun operations at its Mineral Ridge mine, about five miles south of Salem, Ky. The dirt is being trucked to the Mahoning mill, at Rosiclare. At present hoisting is being done by a steam hoist, but a Caterpillar diesel generator has been installed and as soon as possible an electric hoist will be added to existing equipment.

CALIFORNIA

Development work under way at Alhambra gold mine—Dredging operations to start soon in Placer County

★A small crew is doing development work at the well-known Alhambra gold mine, near Kelsey, El Dorado County, reopened early this year under the management of W. W. Williams, Oakland mining engineer. The property yielded more than $1,000,000 of high-grade gold ore a few years ago when it was operated by Alhambra-Shumway Mining Co., and is now reported to be leased to Eastern interests.

★The Ruby Hill drift gravel mine, about 21 miles northeast of Columbia, Tuolumne County, has been acquired by E. J. Norris, and installation of equipment is planned. Development includes a 750-ft. inclined shaft sunk through cemented gravel on the Columbia Channel, still in good condition.

★Work on reassembling the large dragline dredge moved recently from the Oroville field to the Howard Davis placer holdings 8 miles east of Auburn, Placer County, by the Golden Feather Dredging Co., E. A. Wiltsee, is progressing rapidly, and active dredging is to commence soon. Operations are directed by S. J. Norris, Jr., manager.

★E. F. Smith, of New York, and A. H. Heller, of Pasadena, have acquired the May Lundy gold mine, on Mill Creek, in Mono County, and exploration work with a view of developing sufficient ore to erect a milling plant in 1946 is to start soon. The property consists of 23 claims, and is credited with a production of more than $3,000,000 in

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SULLIVAN

California (*Continued*)

the period between 1880 and 1910. A RFC loan was granted in 1935, followed by construction of a mill to treat accumulated tailings. In 1942, the mine was sold after foreclosure proceedings by RFC. Mr. Heller also is a vice president of Tungstar Corporation, operators of tungsten holdings and a concentrator near Bishop, Inyo County.

★Early operation of a limestone quarry, south of Sutter Creek, Amador County, is planned by A. Teichert & Son, Sacramento contractors, with the output to be shipped to the Tracy plant of the Holly Sugar Co. An extensive deposit of high-grade limestone has been disclosed by diamond drilling, and current work directed by Chuck Holman includes improvement of roads preparatory to trucking operations.

★Operation of the Darwin Mines group of lead-zinc properties, comprising the Essex, Columbia, Independence, and others, is proceeding on a substantial scale following acquisition by Anaconda Copper Mining Co., in July. The mines, near Darwin, in the Coso district of Inyo County, were operated by Imperial Metals, Inc., from Jan. 1 to Feb. 28, 1943, when the company was reorganized as Darwin Mines, Arthur J. Theis, trustee, with operations continuing until purchase by the present owners. During 1944 and 1945 production averaged some 500,000 lb. of lead a month, together with large quantities of zinc and silver. Though the bulk of lead output was obtained from direct-smelting ores, a substantial tonnage of lead-zinc concentrates was produced in the 125-ton flotation plant remodeled early in 1944. Mining is carried on to an incline depth of 600 ft. through the Radiore tunnel, in the Essex holdings, and sulphide orebodies are under development in the Thompson and Independence shafts. The property is operated under the name of Anaconda Copper Mining Co., Darwin Mines, and about 100 men are employed under the direction of S. K. Droubay, manager.

★A copper-gold property in the Meadow Lake area near Colfax, Placer County, is being investigated by the U. S. Smelting, Refining & Mining Co., with M. P. Romney, engineer, directing the exploration work.

WASHINGTON

Production at Mead aluminum plant ceases — Government agency employees terminate services

★All production by the Aluminum Company of America at Mead, north of Spokane, has ceased following instructions from C. C. Carr, the company's Pittsburgh director of public relations. A. A. Morrison has been manager of the plant since W. N. Farquhar was called East by the death of his brother. The plant has been employing 800 persons. The RFC has taken over the plant and canceled its leases effective Oct. 31. With this announcement comes the statement that the Trentwood rolling mill, east of Spokane, is reducing its force of more than 2,000 to about half that number. This followed the government's cancellation of large tonnage orders, these orders being chiefly for the War Department and for sheet metal to cover huts for housing soldiers overseas. At the same time commercial work is increasing. War Department orders at the time were understood to be for 23,000,000 lb. of the metal, which would continue production for at least two months.

★The 3,000 persons employed at the two big war production plants in Spokane celebrated V-J day, many of them taking one to two days off, and those who needed to do so worked on a day and a half basis. The reduction plant at Mead continued full tilt on a 24-hour basis to keep the pots from freezing. Alcoa's plant at Mead, under its contract with Defense Corporation, has two years more of its five years to operate unless orders for pig aluminum drop below 40 percent of capacity. The government gets 35 percent of the profits of this plant, which has netted $18,000,000 since it got under way early in 1942. It has been operating four of its six potlines, producing 12,000,000 lb. of pig aluminum monthly. The rated capacity of the Trentwood plant is 120,000 tons a year.

★Dr. Wilson M. Compton, president of Washington State College, has announced that two exhibits of light-metal fabrication and light-metal alloys will be held in October at the Washington State College, at Pullman, and in Spokane. He says the plans include an expansion of the school's institute of technology. The Reynolds Metals Co. and Aluminum Company of America have already agreed to send exhibits to these shows.

★Many changes in the personnel of engineers and other men connected with the several government mining agencies in Spokane will be made. Many of the employes already have been notified that their services are being terminated. Bliss Moore, mining engineer, is reentering private practice. He has represented the WPB in Washington, Oregon, and Idaho. Roger O. Oscarson has been in charge of production in the same field, and is terminating his work. E. P. Oscarson, in charge of the work of the U. S. Bureau of Mines in Spokane, and others in the Bureau's service are completing their work. P. H. Sherman, engineer in charge of mine loans for the RFC and the staff members

in the office of the U. S. Geological Survey in Spokane, have not been notified of any change in the status of their employment.

★Aluminum Company of America reports that mid-West manufacturers are placing orders for aluminum structural materials for their basic needs with the Trentwood rolling mill. These include material for homes and store fronts, resulting from a shortage of lumber.

★Sheldon L. Glover, of the State Division of Mines and Mining, reports that more than 50 occurrences of manganese have been found in the Olympic Peninsula. He has prepared a report on these and another on the geology and ore deposits of Sultan Basin, in the Cascades. The U. S. Bureau of Mines opened a body of hausmannite by diamond drilling. Deeper drilling by the Sunshine Mining Co. at its Lake Crescent property revealed 10,000 tons of ore in lenses more than 900 ft. below the outcrop.

★C. W. Ganoung and C. L. Miles have brought suit in Stevens County, alleging that Chinto Mining Co. and Banner Mining Co. both claim ownerships in the same orebodies and ask that Chinto be decreed the sole owner of the properties.

MISSOURI

Craig Mining Co. starts milling barite — Limestone mine uses jumbo for wagon drills

★Craig Mining Co., of which Will Craig is superintendent, has started milling barite at Cole Camp. The material is obtained from the Craig mine, on Indian Creek, Benton County. One hundred tons of ore a day is being treated, and the mill capacity can be expanded as the mine pit becomes enlarged sufficiently to furnish greater tonnage. The deposit is reported to be one of the richest barite occurrences in central Missouri. The crude ore averages approximately 30 percent $BaSO_4$, is essentially iron-free, and furnishes good chemical-grade barite. Mill concentrates average better than 98 percent $BaSO_4$. Other adjacent barite properties are owned by the Craig Mining Co., and these will be developed as soon as conditions make possible.

★The U. S. Bureau of Mines is directing drilling projects for barite in central Missouri. It is reported that three deposits have been drill-tested to date.

★It is reported that the A. P. Green Co. has recently discovered two new diaspore clay deposits in Gasconade County.

★According to data compiled by the staff of the Missouri Geological Survey, there are 1,159 known mineral

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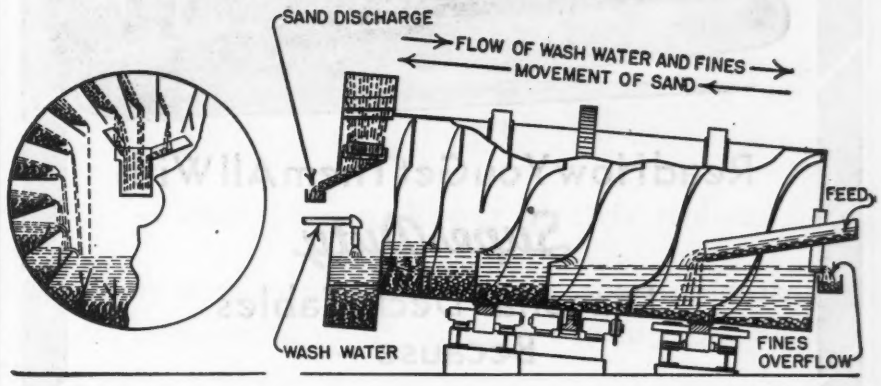

WHY Counter-Current? Because the oversize ascends against a descending stream of liquid.

4 CLASSIFYING PRINCIPLES

1. UNDISTURBED FREE SETTLING — a quiescent primary pool, free of any zone of turmoil, in which settling takes place according to size-density.
2. SCRUBBING ACTION OF SETTLED SOLIDS — settled particles gradually progress up the revolving helical internal launder. A rolling action sufficiently active to scrub particles free of adhered fines takes place without abrasion of the classifier drum or the guiding flights integral with the drum.
3. EFFECTIVE HINDERED SETTLING — as the fines are scrubbed free and rolled above primary pool level, they are subjected to the action of the counter-current flow of liquid cascading from each flight or secondary pool into that pool immediately below it. An uprising current occurs throughout the rolling mass, washing the freed fines back into the primary pool of the classifier.
4. SAND WASHING — the empty, descending, sand wheel buckets are filled automatically and continuously with liquid for the counter-current. Sands from the drum flight launders are discharged into the filled buckets. The last vestige of fines are carried down the classifier with the counter-current.

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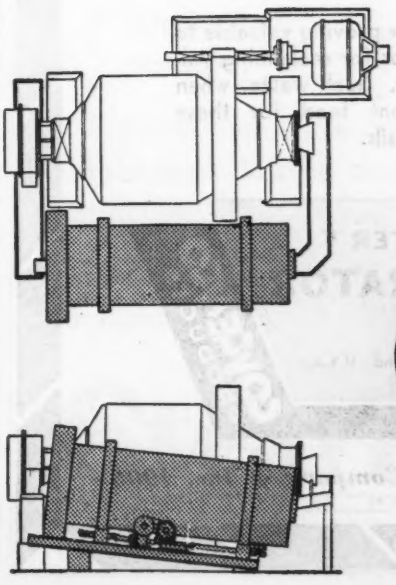

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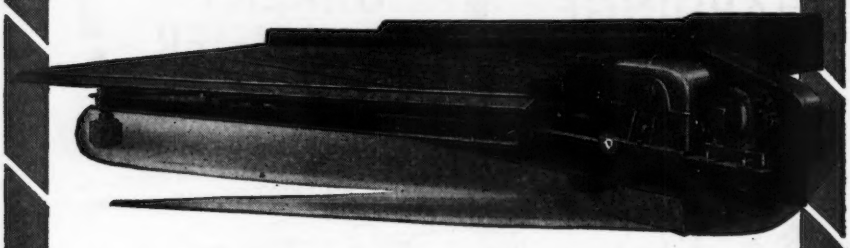

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Missouri *(Continued)*

deposits in the Meramec River Basin. These statistics were assembled chiefly for use of the U. S. Army Engineer Corporation, St. Louis office, to aid in their study of water resources of the Meramec Basin.

★The Stewart Sand & Materials Co., of Independence, has begun using a caterpillar jumbo similar to that developed for rock drilling by the Eagle-Picher Mining & Smelting Co. in the Tri-State district. Wagon drills are being adapted instead of Leyner drifters. The installation by the Stewart Co. is believed to be the first application of this recent improvement in drilling practice to underground limestone mining in the Kansas City region.

IDAHO

Sidney Mining Co. awards contract for mill—Nabob Mining Co. starts mill construction

★Sunshine Mining Co. has declared its third quarterly dividend of 10c. a share for 1945. The payment to stockholders totals $158,882 and is payable Oct. 1 to stock of record Sept. 1. Total dividend payments this year by Sunshine total $446,646, and the dividends to date total $24,987,417.

★For the first six months of 1945 the Sidney Mining Co. has received net smelter returns of $272,590 from ore shipments, most of which have been produced in development work. The company has recently awarded a contract to the Western Knapp Engineering Co., of San Francisco, for the construction of a 250-ton concentrating mill to be erected at the mine, on Pine Creek.

★The Lucky Friday Silver-Lead Mining Co. is driving a drift on its vein on the 1,000-ft. level westerly toward the Lucky Friday Extension property, in which the Lucky Friday company holds a half interest in the net proceeds from ore produced. It will take about 1,000 ft. to reach the Extension property line. The Lucky Friday company has mined more than 2,000 tons of high-grade ore from drift development work on the 1,000-ft. level. The ore is in a stockpile at the mine and will be treated at the Golconda custom mill.

★Leasers of the Hunter mine, at Mullan, have awarded a contract to William Coumerilh and Clarence Nelson to move several thousand tons of mill tailings and mine dump material to the Hunter mill for re-treatment. The tailings were deposited in the creek bed years ago at a time when the milling practice saved only about 60 percent of the values in the ore. The material is low grade, but the pre-

mium price paid for lead makes the operation profitable.

★The Nabob Mining Co. has started grading the foundation for a milling plant on Pine Creek between the towns of Beeler and Masonia. The new milling plant will be connected with a new lower tunnel planned for immediate construction.

★The Coeur d'Alene Mines Corporation has completed its main shaft from the 2,200 to the 2,400 level and is cutting a sump and skip pocket on this new level preparatory to driving a crosscut to a silver vein previously prospected on the 2,200 level, about 200 ft. south of the shaft. The company's original vein is about 1,000 ft. south of the shaft and will again be opened on the 2,800 level.

★Triumph Mining Co. operating the Triumph lead-zinc mine, at Hailey, Idaho, announces the resignation of A. M. Jensen as general mine superintendent and the appointment of A. H. Shoemaker to fill the position. Jensen resigned to devote his attention to the development of the adjoining Snoose mine. The Triumph mine has developed into the largest zinc-lead mine in the State outside of the Coeur d'Alene district. It was formerly owned by the Federal company, of this district, which still retains a large interest in the operation.

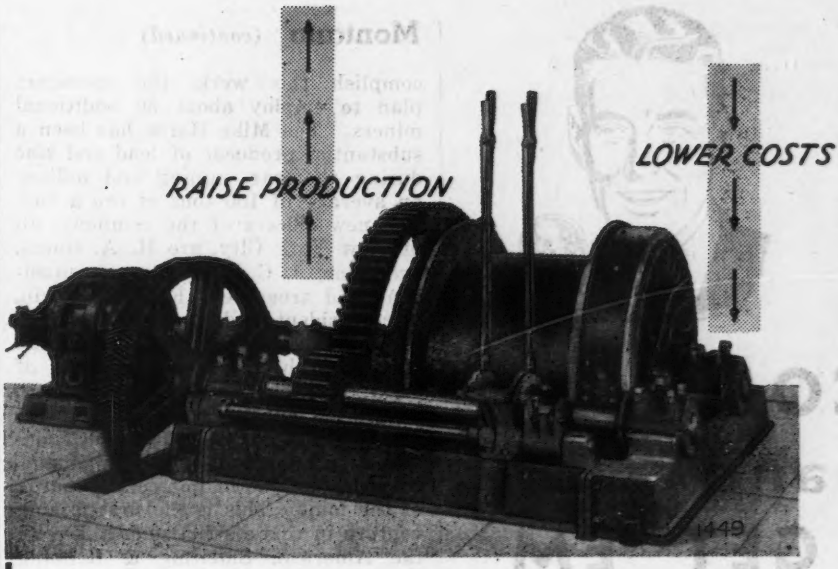
★The Mineral Exploration & Research Corporation, of Yakima, Wash., has acquired the Stowell gold mine property, on the south fork of the Clearwater River between Golden and Elk City, and is constructing a 125-ton amalgamation and flotation milling plant.

★Wendell Morse has taken a five-year lease on the old Lone Pine mine, at Golden, Idaho. It is expected that rehabilitation work will start in October, and development work will be done during the following months. This property was closed down by L-208.

MONTANA

A.S.&R. purchases Mike Horse mine—U.S.B.M. completes exploration of iron deposit in Teton County

★The entire capital stock of the Mike Horse Mining & Milling Co. was recently transferred from R. F. Porter and associates to the American Smelting & Refining Co. The company is reported to have paid $800,000 for the mine and equipment. A.S.&R. which operates a lead smelter at East Helena, plans to initiate an intensive exploratory and development program at the mine, which is in Lewis and Clark County near Lincoln. To ac-



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Montana (*continued*)

complish this werk, the operators plan to employ about 30 additional miners. The Mike Horse has been a substantial producer of lead and zinc during the war, mining and milling an average of 150 tons of ore a day. The new officers of the company, all of New York City, are H. A. Guess, president; J. C. Emerson, vice president and treasurer; R. F. Goodwin, vice president, and G. A. Brockington, secretary. Operations at the Mike Horse will be under the direction of H. G. Washburn, manager, and J. E. Berg, assistant manager, both of Wallace, Idaho, and A. E. Haeseler, general superintendent, of Mullan, Idaho. Haeseler will be in immediate charge of the mine. This is the first mining venture in this district undertaken by the American Smelting & Refining Co. The company now has a scout in the Montana district and plans to examine numerous mines in search for additional properties.

★The U. S. Bureau of Mines recently completed a program of exploration at the Choteau iron deposit, in Teton County. A total of 78 short diamond drill holes were drilled under the supervision of D. S. Hoiekvam, Bureau engineer. Metallurgical tests are being conducted at the Bureau's Salt Lake office to determine the amenability of the ore to beneficiation. A detailed topographic map of the area has been prepared as part of the exploratory program. Results of the project are not yet available.

★The Last Chance Gulch Mining Association held its fall meeting on Sept. 20. Several members of the State Bureau of Mines and Geology attended and were called upon to outline the functions of the organization. J. M. Conrow, assistant director, outlined the general program of the bureau. Oscar Dingman explained how the bureau plans to assist prospectors and small operators in the field. Dr. S. R. B. Cooke described the laboratory facilities that were available for helping small operators. Each member of the staff urged the mining industry to take advantage of the services offered. Tom Oster, engineer consultant of Montanans, Inc., spoke briefly on the newly created Industrial Development Division and described how it plans to assist the mining industry by locating or developing markets for the less common metallics and non-metallics. A general discussion of the problems affecting the resumption of gold mining completed the evening's business meeting.

★The Mt. Washington mine, in Jefferson County, has temporarily ceased production. J. C. Archibald, president of the operating company, states that a program of exploration will be carried out during the winter months.

ARIZONA

Phoenix branch of Alcoa suspends operations—Warren lead-zinc mill to be completed soon

★The Phoenix branch of the Aluminum Company of America recently suspended operation due to cancellation of government war contracts. The plant is owned by the Government and it is said to represent an investment of $65,000,000. At its peak production in July of this year the plant employed 2,900 workers. This project started operating in May 1943 but did not reach full production until this year, when 26,000,000 lb. of aluminum was produced since the first of the year.

★The Sahuarita custom mill of Eagle Picher Mining & Smelting Co. is continuing to treat about 400 tons of lead-zinc ores daily. In addition to the custom ore treated the mill is processing about 150 tons daily of its own lead-zinc ores derived from the company's mine at Twin Buttes. Sam Duff is mine superintendent; Neill Parker is mill superintendent. Grover J. Duff, with headquarters at 73 North Court St., is Tucson, is general manager of the entire operation.

★The Warren lead-zinc mill of Phelps Dodge Corporation is expected to swing into full production by the latter part of this year. At present the mill is under construction and is nearing completion. It will treat about 400 tons daily of lead-zinc ores derived from the Phelps Dodge mines in the Bisbee district. Thomas Thompson has been appointed mill superintendent, and J. K. Sellers has been named metallurgist for the milling operation.

★The custom mill of Shattuck Denn Mining Corporation is continuing treatment of lead-zinc ores. Phelps Dodge Corporation, Bargin Mines, Inc., and The State of Texas mine are the main shippers. They are treating 125 tons daily, and the concentrates are shipped to El Paso and Corpus Christi, Tex. J. S. Hamilton is mill superintendent.

★A. C. Nebeker, field engineer for the Arizona Department of Mineral Resources, has received many inquiries on gold properties, gold placers, and the possibilities for custom milling in the Prescott district. An inquiry on custom mill possibilities came from F. R. Viehle and Mr. Hall, who are planning a 100-ton custom mill if they can find an area with enough shippers to justify the project. Mr. Nebeker believes that if the mining people would cooperate, the Prescott district could produce enough ore to warrant the mill. Payment for ore would be made on assay at the time ore is received, which would supply the little operators with capital to carry on

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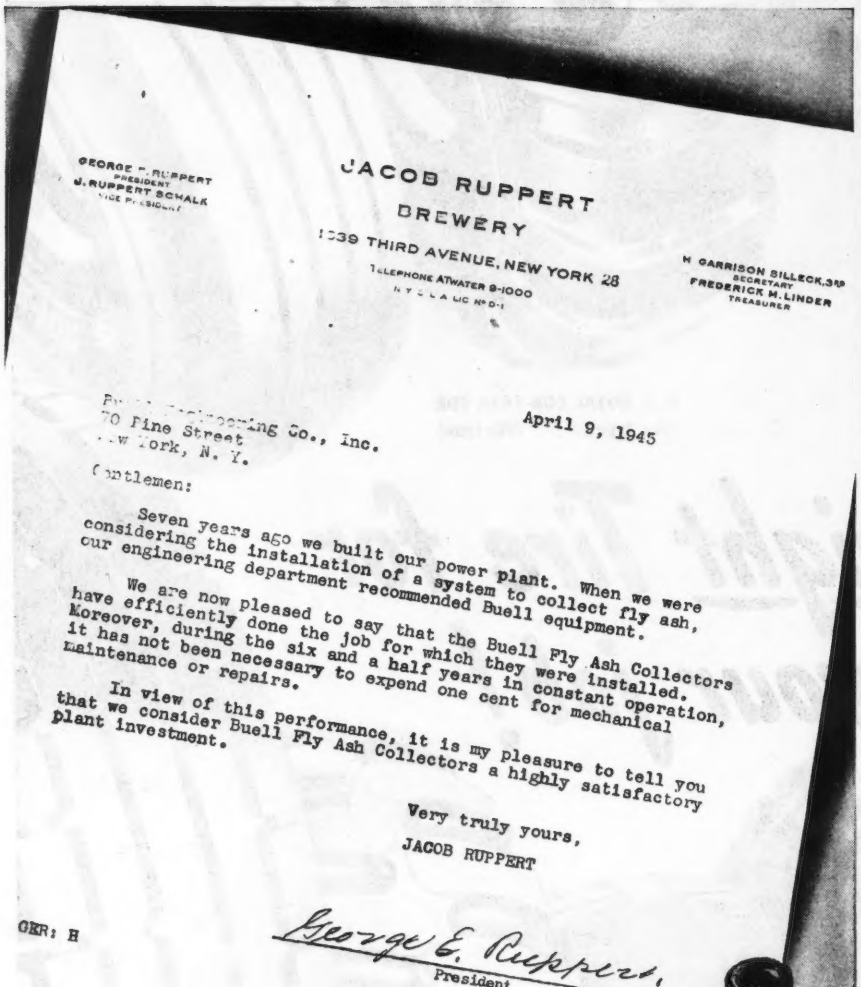

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Arizona *(continued)*

operations without waiting until a carload of concentrates is ready to ship.

★Fred R. Yoakum and A. R. Pilant have taken over the Sun Dance mine from Edward F. Rippey. The property is in the Hassayampa district about two miles south of Prescott, and expect to produce ore soon.

★J. H. Ryan and Vinson Ryan have leased the Producer mine and mill (the old Pilgrim mine), in the Chloride district. They plan to examine the Chloride district, and equip the Producer mill with flotation units for ore, if conditions are favorable.

★A. C. Haigler, who owns the Rand mine and the Independence mine, northeast of Morristown, in Yavapai County, is prospecting and developing these two properties. The ores carry lead, copper, silver, and gold.

★Charles Craig, of the Mt. Spring property, east of Hillside, reports that a shaft has been sunk to 45 ft., exposing a vein 3 to 3½ ft. wide, from which he has made a small shipment assaying 42 percent lead, with silver and gold, bringing value of the ore up to $50 per ton. He plans to continue sinking and drifting on the vein. Mr. Craig is also contemplating a gravity concentrator to treat the low-grade ore. The mill will consist of a crusher, rolls, Wilfley tables, and possibly a jig. If necessary a flotation plant will also be installed in the near future. The new mill may be used for custom work for neighboring properties.

★Valerio Rossi is operating the Copper King mine, west of Hillside, from which he has been producing over 300 tons a month of zinc, copper, lead ore with a little silver, but values largely in zinc. A gasoline hoist has been installed recently.

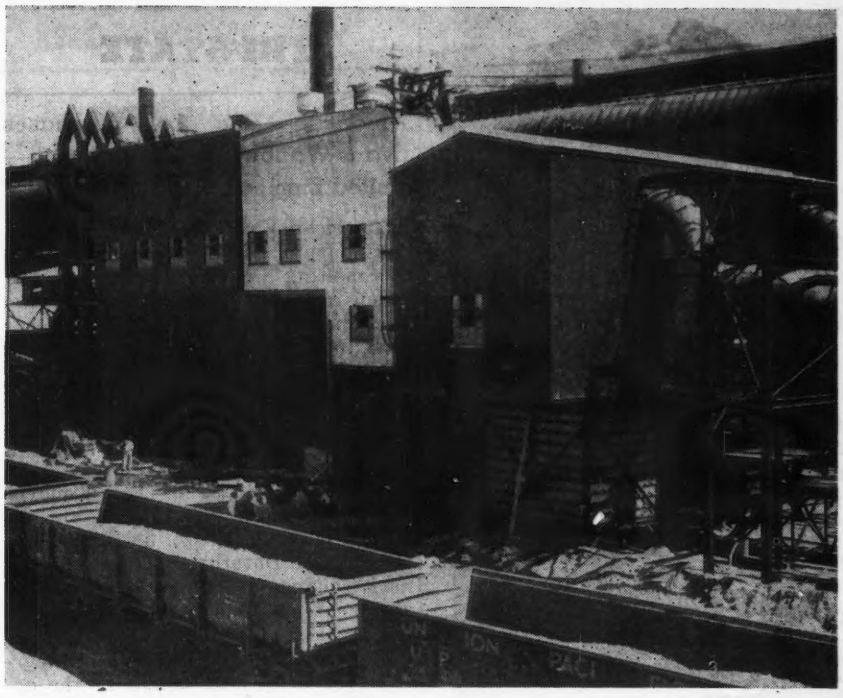
★Robert S. Kipp is working the Dough Boy mine, a gold property near Hillside, and is equipping it with a compressor, hoist, and other equipment.

★E. C. Widby is starting operations on the Cave Creek mine, in the Cave Creek district, and his showing is sufficiently important at this time that Widby expects to be shipping regularly within the next 60 days, producing lead and zinc ore.

UTAH

New Garfield sulphuric acid plant in full operation—Utah Copper to spend $2,500,000 for improvements

★The new $1,000,000 sulphuric-acid plant of Garfield Chemical Co. was in full operation Sept. 11, supplying 150 tons per day of 98 percent pure sulphuric acid, according to an



SULPHURIC ACID PLANT of the Garfield Chemical Co. produces 150 tons of 98 percent pure acid per day for several Western basic industries.

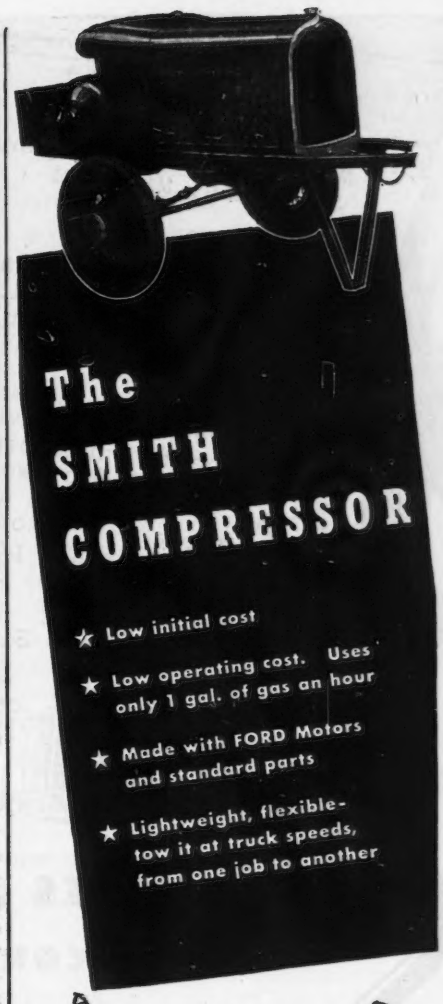
announcement by William J. O'Connor, chemical company president and Utah department manager, American Smelting & Refining Co. The new plant, and a 100-ton plant in operation since 1937, will enable the company to supply acid needs of a recently completed $750,000 superphosphate fertilizer plant operated by J. R. Simplot at Pocatello, Idaho, and also supply steel, paper, borax and high-octane gasoline plants of the Western area, Mr. O'Connor said. The main catalyst-converter portion of the plant is housed in a large building used prior to 1937 for a lead chamber acid plant. This is connected by a 1,500-ft. lead flue with the new hot Cottrell, power plant and scrubbing towers. R. A. Peters, of Chicago, superintendent of the Leonard Construction Co., said more than 340 tons of lead were used in building the plant. Construction required almost a year. Garfield Chemical Co. is owned jointly by A.S.&R. and Utah Copper Co. D. D. Moffat, copper company president and general manager, is vice president of the chemical company.

★After operating under Army control for seven months, the Bingham & Garfield Railway Co., affiliate of Utah Copper Co., went back into private operation Aug. 29. The line went under Army supervision Jan. 25 when a strike of the Brotherhood of Locomotive Firemen & Enginemen threatened production of the copper company. The short strike followed demand by the brotherhood that a second man be used in each cab of switching locomotives. A special presidential board previously had denied the brotherhood's claim.

★Utah Copper Co. is preparing to spend more than $2,500,000 for improvements, many of them necessary to enable the company to compete successfully in the postwar copper market, D. D. Moffat, president and general manager, told Salt Lake Kiwanians at a recent meeting. Now planned, he said, is $2,500,000 for installation of a second 50,000-kilowatt generator unit, and additional large sums for new housing for workers, particularly at Copperton, and for machinery and equipment upon which normal maintenance and replacement was halted because of the war rush. Utah Copper Co., he said, is the world's largest single mining enterprise and has produced about 28 percent of the country's new copper and from 5 to 6 percent of all new copper in the world during the war period. Sixty percent of the company's expense last year, he said, was for taxes.

★Wage contracts affecting approximately 10,000 members of district union No. 2, Mine, Mill & Smelter Workers (C.I.O.) in Utah and Nevada now have been certified to the nonferrous metals commission by H. McEwen, conciliator, J. Frank Marble, president-secretary of the district, reported Sept. 7. Points on which the operators and the union failed to agree, he said, include union demands for a 35-hour work week, sick leave, and a guaranteed annual wage.

★Tintic Standard Mining Co. has declared a 2½c dividend payable Sept. 29 to stockholders of record Sept. 14, James W. Wade, president, announced. The dividend will amount to $28,502, making a total of $85,506 paid for the year, bringing grand total paid to $19,007,088.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TRI-STATE

American Zinc Co. purchases Evans-Wallower zinc property—United Zinc completing mill

★American Zinc Co. of Oklahoma, a subsidiary of the American Zinc, Lead & Smelting Co., has purchased and taken over the operation of the No. 7 property of the Evans-Wallower Zinc, Inc., according to a statement by John J. Inman, district manager for the American company. The property, which is northeast of Cardin, comprises the Evans-Wallower No. 7 mill, mines, and 200-acre lease. Included in the 200-acre tract of the Kenoyer land, besides the No. 7 lease, are the Evans-Wallower Nos. 3 and 8, La-Clede, and Dorothy Bill leases. No major changes in plant or equipment are contemplated for the present, Inman said. Ralph E. Calhoun, assistant district manager for the American company, was active in the acquisition of the property and will continue as such under the new management. W. F. Netzeband will be superintendent in charge of operations. According to Floyd Gooch, manager of the Evans-Wallower company, the company will continue its operations at the No. 4 property.

★The United Zinc Smelting Corporation is completing the concentrating part of its mill on the Park-Walton lease, southwest of Melrose, Kan. Material and equipment are being removed from the old Barr mill, north of Picher, in Kansas, which was acquired some time ago from the Eagle-Picher Mining & Smelting Co. Work on the concentration plant was started around the first of August and is expected to be completed within 90 days, according to D. G. Harrison, of Joplin, district manager of the company. Ore from the two shafts on the lease has been trucked to the company's Royal mill, southeast of Picher, for nearly two years. In addition to development work and mining carried on at the 310-ft. level, which contains principally lead ore, crosscuts have been driven from both the Nos. 1 and 2 shafts on the 350-ft. level to a narrow run of low-grade zinc ore. Churn drilling has indicated ore of better grade some distance to the south, Harrison said. He reported that heavy water is frequently encountered when drilling and shooting underground on the lower level, flooding the workings there for several days at a time before it can be lowered sufficiently to resume mining operations. The water is being handled by four direct-driven electric-powered Pomona pumps—one of 50 hp. and the others of 150 hp. each. The inflow of water being handled is around 2,500 gpm, but fluctuates upward considerably when new reservoirs of water are tapped.

IRON COUNTRY

O.P.A. studies request for relief from price ceilings—A 500-year future for Minnesota iron mines is estimated

★E. W. Davis, director of the University of Minnesota Mines Experiment Station, took a long look ahead today and foresaw a 500 year future for the iron mining industry in Northern Minnesota. He added that current developments indicate that iron mining and affiliated industries will provide increased employment during the next few years. His comments were occasioned by repeatedly expressed fears that Minnesota iron ore reserves are nearing the vanishing point and the proposal of W. R. Van Slyke, Eveleth mining engineer, that the government take over 300 to 400 million tons of Minnesota ore "as a safeguard against future wars." The outlook for Minnesota iron mining is most optimistic, Davis said in an interview. "I firmly believe that the state can look forward to another 500 years of mining activity." Latest estimates on Minnesota iron ore reserves by the state tax commission fix the total at about 1,060,000,000 tons. Of this 512,000,000 tons is direct open pit ore, 380,000,000 tons underground direct ore, and 160,000,000 tons of concentrates. The total represents a drop in the last 30 years of more than 364,000,000 tons, nearly two-thirds of it in the last ten years. But this situation is not necessarily serious in Davis' view. It does not take into account the vast tonnages of taconites which the university expert expects to form the basis for future development.

★With a decrease of 1,556,449 gross tons compared with a year ago the iron ore shipments from the Lake Superior district totaled 10,731,804 gross tons for the month of August. The season's shipments to Sept. 1st totaled 51,128,672 compared to 54,574,155 gross tons last year. The smallest shipment over any dock was Port Arthur, Ont., totaling 34,310 tons which is over twice the amount shipped last month. Only ore from the Steep Rock mine comes over this dock.

★On August 30th Warren M. Huff, chief of the metals branch of the O.P.A. conferred at Ishpeming, Mich. with officials of the Cleveland Cliffs Iron Co. and the North Range Mining Co. relative to their application for relief from price ceilings on iron ore. He had just completed a visit to the Mesabi and Gogebic ranges securing knowledge of factors which enter into the field of price ceilings. With him on the trip were V. P. Gefine, vice-pres. of the Cleveland Cliffs Iron Co. and Herbert Jackson, vice-pres. of Pickands Mather Co.

★On the Gogebic range stripping continues on the north side of the Plymouth mine pit, under the direction of Peter Kiewit & Sons Co. who received a contract last year from the Pickands Mather Co. At present the work is about one half completed, using twelve trucks and two shovels.

★Due to a petition by the Puritan Mining Co. claiming that their real property in the City of Bessemer, Mich. had not been assessed according to law, a public hearing was held at Bessemer to review the 1945 valuations on the Tilden and Colby mines. The 1945 local board of review assessed the Tilden at $150,000 and the Colby at $100,000. The petition asked that the Tilden be reduced from $150,000 to $75,000 and the Colby from $100,000 to $35,000 to be effective during the exploration work of the company, that is now being carried on. After consideration the State Tax Commission changed the assessment to the reduced valuation.

★Recently contracts were signed by the North Range Mining Co. and C.I.O. union governing conditions of employment for the men at the Blueberry, Rolling Mill and Book mines. Directives of the War Labor Board were written into the contract, all of them retroactive to Jan. 1944 but all other provisions became effective as of date of contract. Negotiations are now under way for a similar contract between the union and the Cleveland Cliffs Iron Co.

★Large quantities of bog peat in Minn. and Mich. have led to experiments and consideration to utilize it for the generation of electric power and eliminate the use of coal and lignite. According to past surveys Minnesota contains six billion tons of air dried peat, Wisconsin has 2½ billion and Mich. one billion. The drawbacks to its use are: 1. Excess cost of digging. 2. Too much bulk for low cost transportation. 3. Low heat value per ton, not exceeding 7000 B.T.U. per lb. These drawbacks have stopped its extensive use in the past but now Russia claims to overcome these hindrances and has many plants in operation burning peat exclusively, the largest plants generating over 150,000 K.W. They overcame the first trouble by hydraulic digging using pressures on the nozzles up to 150 lb p.s.i. and pumping into drying cars. Troubles No. 2 and 3 were corrected by setting the power plant in the bog and transporting only the generated electric energy. Minn. has become so interested in peat that the last legislature appropriated $25,000 for research. As iron ore beneficiation requires more power per ton as the grade of the ore gets lower if this power can be made for half the present cost per K.W.H. by using peat the value to the state will not only be a longer life for the mines at a lower cost per ton for ore but will develop a new industry that may find many other uses.

ARKANSAS

Alcoa, Reynolds Metals, and A.S. &R. interested in Hurricane Creek aluminum plant

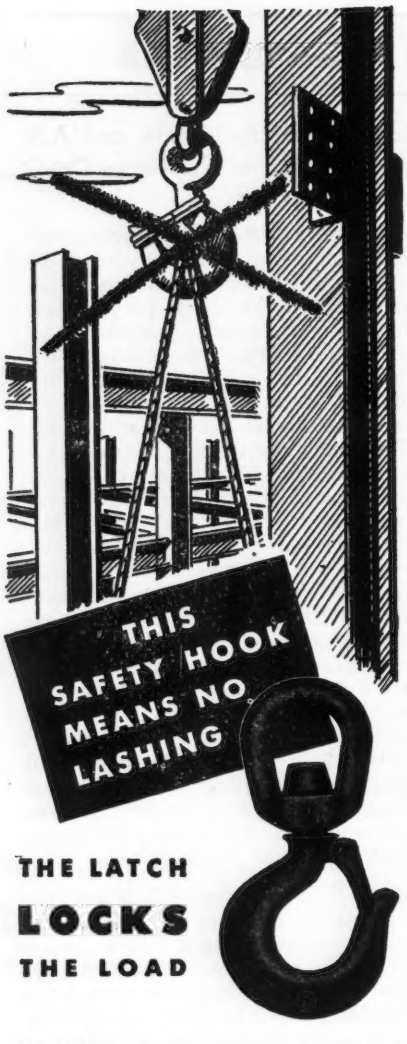
★Arkansas's $80,000,000 government owned aluminum plants may be closed Oct. 31. The Aluminum Company of America built the plants for the Government and has been operating them under lease. The leases have been cancelled by the Reconstruction Finance Corporation as of Oct. 31. Three companies have notified the R.F.C. that they want to buy or lease the plants, which consist of an aluuminum plant at Hurricane Creek near Bauxite and the Jones Mill aluminum plant near Malvern, Ark. The three companies are Aluminum Company of America, Reynolds Metals Company, and American Smelting & Refining Co. The R.F.C. has indicated that it desires to negotiate a sale or lease of the plants to one of the companies so that it may resume operations with a minimum loss of time. Any other corporation capable of operating the plants may bid for the property. About 2,000 persons are employed at the two plants, which were built in 1941-42.

★The U. S. Bureau of Mines has terminated all active exploration projects in the State. The future status of the proposed experimental bauxite mine has not been announced. Considerable work remains to be completed in the preparation of reports on the extensive bauxite drilling exploration that was carried on by the Bureau during the war.

★Operations in the Batesville-Cushman manganese field are back to normal except for labor shortage which is expected to be remedied shortly by men returning from defense plants and boys from the Army and Navy. Production in the field in August ran to a total of 1,306 tons, of which 708 tons were low grade and 598 tons high grade. All of the high grade was purchased by the Metals Reserve buying depot, at Batesville, Ark.. Major Ruggles in charge. All of the low grade was shipped direct to the furnaces.

★The Arkansas Manganese Co., operating on the Aydelotte property near Cushman, Ark., Jack Gibbons in charge of operations, was the largest producer in August. Its total production ran to 465 tons, of which 308 tons were low grade and 157 tons high grade.

★Davis Mining Enterprises, operations in charge of John Mothershead, Batesville, Ark., produced 400 tons of high grade in August. Early in September Davis Mining Enterprises sold its milling plant to R. P. Potaschick & Co., of St. Louis. Oper-



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Arkansas (*continued*)

ations are in charge of H. E. McBride. The latter has leased the Southern Hill and other properties. Pit mining operations will be carried on by the new firm, which will bring in about $200,000 worth of new equipment consisting of tractors, scoops, one two-yard and one four-yard power shovel. With this new equipment it can supply the plant with enough crude ore to operate three shifts a day. The fee title of the Southern Hill is owned by the Southern Hill Mining & Manganese Co. The Davis Mining Enterprises also sold the big washing and concentrating plant which was purchased from the Hendricks Mining & Milling Co., to the Polk-Southard Mining Co., a newly organized company from St. Louis. Stripping and pit mining operations will be carried on at the Polk-Southard property. Some improvements on the mill will be made and it will probably be early in November before the plant is in production. The fee title of the Polk-Southard is owned by the Southern Hill Mining and Manganese Co.

NEVADA

Flotation and cyanide plants to resume operations—National Lead acquires barite claims in Clark County

★The Cons. Chollar, Gould & Savage Mining Co., Thomas V. Barton, manager, has cleaned up and is preparing to operate its 400-ton sodium-cyanide mill on the Comstock lode at Gold Hill as soon as earth-moving equipment can be obtained to deliver ore from its open-cut mine. The mill was leased last year to the Virginia City Mining Co., Guy M. Standifer, of San Francisco president, to treat surface ore from the leased Cons. Virginia mine, but low grade of ore caused abandonment of the project.

★Production in 1944 of the bucket-line dredge of the Manhattan Gold Dredging Co., controlled and operated by the Natomas Co. of California, working a single shift under WPB permit, yielded net profit of $39,044, against $98,704 in 1943. John L. James, manager, reported some 3,000,000 cu. yd. of gravel remaining to be dredged, or another year's supply. Natomas holds under lease and option the 6,000-acre Greenan placer tract south of Battle Mountain, below Copper Canyon, where it had installed a 10,000-yd. dragline dredge before Order L-208 halted gold mining.

★Preparation is being made to resume production from the 100-ton selective-flotation mill of the Rip Van Winkle Cons. Mining Co. in the Merrimac district, Elko County. In the early war years the property was one of Nevada's foremost producers of zinc, lead, and silver, and the mine is one of the county's oldest. George B. Thatcher, of Reno, is president, and the directorate is composed of officers of the Utah Copper Co.

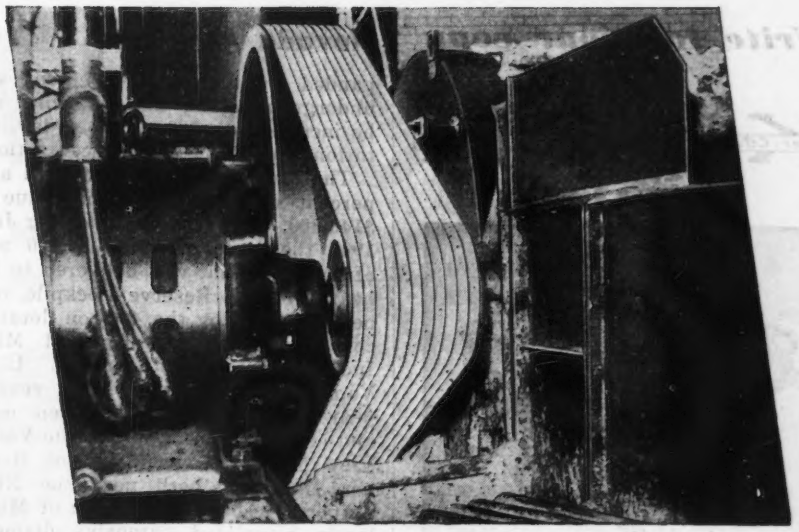
★Getchell Mine, Inc., compelled in June to close down its productive gold mine and 1,000-ton cyanide mill in the Potosi district of Humboldt County because of labor shortage, lately entered into a contract with government agencies to treat 80,000 tons of scheelite contained in a Metals Reserve Co. stockpile a mile south of the plant.

★National Lead Co., one of the largest producers of barite for the paint industry, has acquired claims embracing deposits of barite and long owned by A. G. Klinger, two miles south of the Basic Magnesium, Inc., plant, in Clark County. L. R. Cochran, geologist for National Lead, was said to have let contracts for deep drilling and to provide water supply. The company has long operated one of the largest U. S. producers near El Portal, Calif., and in late years has taken options on barite deposits in two northern Nevada counties. Until early this year National Lead owned 90 percent of Combined Metals Reduction Co. at Pioche.

★New activity is in prospect in the old Gold Mountain or Tokop district, 35 miles south of Goldfield, where the Alberto gold property, now embracing the old Texas-Kelly mine, worked in the '70s and again during the Goldfield boom, has been examined and sampled for the owner, L. W. Fliegner, of Oakland, Calif., by Addison N. Clark, California engineer. Nearly adjoining, on the strike of the Texas-Kelly vein, is the famed Rattlesnake mine, ore specimens from which were awarded first prize at the 1876 Centennial Exposition in Philadelphia.

★Uranium deposits at two points in Lyon County, owned by Ernest L. Rink, of Yerington, were investigated on several occasions during the past two years by engineers from federal departments at Washington, Rink has revealed since V-J day. Many samples were taken and radioactive properties of the ore were discussed, but no mention was made of the atomic bomb.

★Purchase by the United States Vanadium Corporation of the Riley tungsten mine and 200-ton concentrator of the Northern Nevada Mining Co., in the Potosi district, eastern Humboldt County, is verified by Joseph E. Riley, president-manager and controlling owner of the Northern Nevada. Vanadium corporation officers visiting the mine and completing the transaction were J. R. Van Fleet, president; Blair Burwell, general manager; Clarence H. Hall, field engineer, and M. N. Shaw, in charge of the Pine Creek mine and 1,400-ton plant near Bishop, Calif. Equipment is being delivered for greatly ex-



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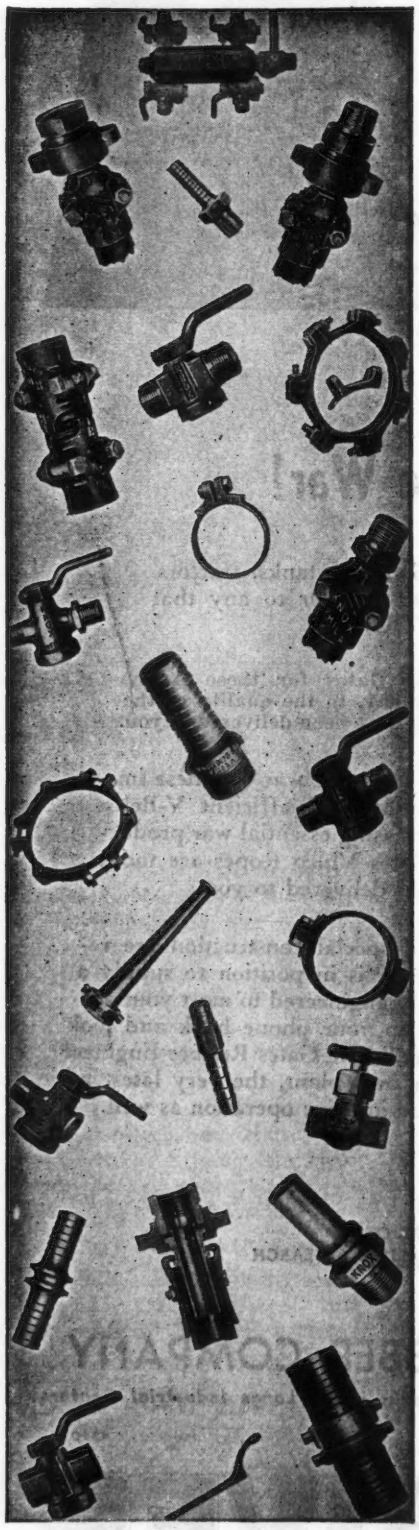

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Nevada (*continued*)

panded mining, both open-cut and underground, and mill capacity will be increased to 500 tons per day, flotation replacing table concentration.

The present mill has produced a 70 percent concentrate to the value of $140,000. In the year following June 1943 the mine produced 80,000 tons of scheelite that was delivered to the nearby Metals Reserve stockpile, now being treated by the 400-ton flotation concentrator of the Getchell Mine, Inc., two miles to the north. U. S. Vanadium has owned for several years the Richmond tungsten mine and has taken an option on the Valley View property, owned by Don Burgner, of Reno, both near the Riley property. The U. S. Bureau of Mines lately completed extensive diamond drilling of the Riley property, its reports indicating scheelite deposits among the largest it has investigated. Concentrate from the enlarged mill will be trucked to Vanadium's chemical plant at the Pine Creek project.

COLORADO

U.S. Vanadium mill on standby basis — Agencies will conduct Colorado mineral resources survey

★The U. S. Vanadium Co. mill at Durango, has been placed on a standby basis, and most of the 50 men formerly employed have been transferred to other U. S. Vanadium properties, including Bishop, Calif. Tom Brock, former superintendent at Durango, has been transferred to Grand Junction. The Durango mill had been milling ores from the Dove Creek district. The U. S.-owned uranium mill operated by U. S. Vanadium Co., and superintended by Harry G. Gardner, is still in operation. According to Gerald L. McAuliffe, head of the U. S. Department of Justice' Anti-Trust Division in Denver, the special grand jury which has been investigating affairs of U. S. Vanadium Corporation, and Vanadium Corporation of America will not be able to report for several months. It is investigating to determine whether there have been anti-trust act violations by the two companies.

★The Propèr mine has resumed operations at Cripple Creek. It is in Poverty Gulch, and is owned by the Cripple Creek Stratton Mining & Development Co., but is leased to Golden Cycle, which in turn has subleased it to Shamrock Mining Co., of Denver, headed by J. Ban Ross. George McKelvey is superintending the operation. The company plans first to consolidate its own operation, and then perhaps to offer blocks for subleasing.

★Fred Polkinghorn and Joe West, Victor's fire-police force, obtained the community national publicity recently with their "Jailhouse Lease." Finding time heavy on their hands due to a dearth of crime and fires in Victor, the two have been digging ore from a ditch in the 50-foot rise right behind the jail. They shipped 30 tons recently, which was expected to settle at about 0.23 oz. of gold per ton.

★Charles Beatty was elected 1945 President of Lake County Mining Assocation at a recent meeting. George S. Casey was named vice president, and John Hamm, retiring president, became secretary-treasurer. According to Mr. Hamm, Congressman Robert F. Rockwell, who toured the district during a recent recess of Congress, said there is still some slight hope of a deficiency appropriation later this year of $485,000 to complete the deep-drainage tunnel to the nearest edge of the mineralized areas. Otherwise the appropriation will have to be obtained, if at all, through a regular Interior Department appropriation bill at the next session of Congress.

★Recent appointments by Governor John C. Vivian include those of Arthur M. Lorenson, of Silverton, to the Mineral Resources Board, and William J. Schenler, of Pueblo, (C.F.I.) to the Mineral Resources Board, and C. Q. Schlereth, of Denver and Idaho Springs, to the Metal Mining Fund Board. Other members of the Mineral Resources Board include J. M. Kleff, Leadville; Dr. M. F. Coolbaugh, president of Colorado School of Mines, Golden; C. O. Withrow, Denver; C. N. Bell, Ouray; Oscar Johnson, Denver; Walter E. Scott, Jr., of Central City, and John W. Valentine, of Boulder.

The Mineral Resources Board of the U. S. Bureau of Mines, the Bureau of Reclamation and the U. S. Geological Survey will co-operate in a survey of the mineral resources of Colorado, to be undertaken by John W. Vanderwilt, Jr., for postwar development. The Metal Mining Fund directors have voted to contribute $4,000 (which will be added to $25,000 appropriated by the Legislature), both sums to be matched by the U. S. government, for a study of nonmetallics in Colorado, largely on the part of the Geological Survey.

★A. H. Bebee has been named general manager of the Golden Cycle Corporation and will have offices hereafter both in Cripple Creek and at Colorado Springs at the main offices of the corporation. He has been vice president of the corporation in charge of mining properties at Cripple Creek.

Mr. Bebee said the corporation's postwar plans are not much further along than they were on VE-Day, due to the lack of manpower so far. However, he said one of the first jobs it undertakes will be to complete laterals from the six-mile main Carlton Tunnel, completed just before the war, to drain the Cresson and Vindicator shafts.

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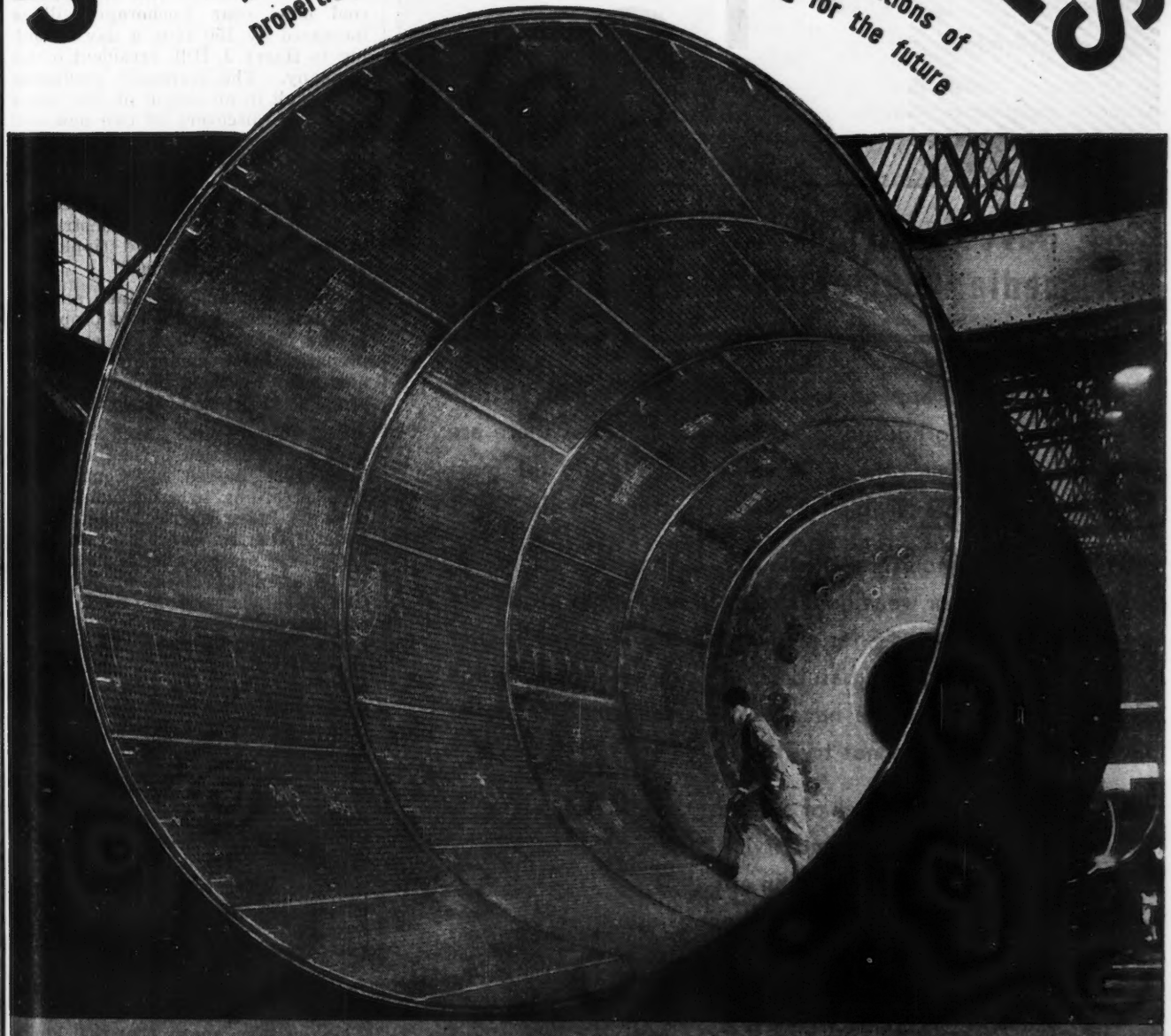

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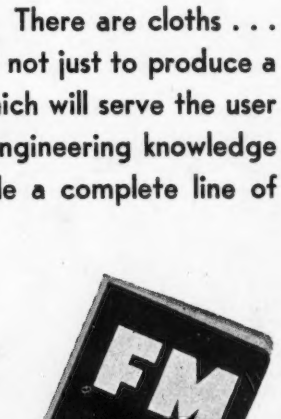

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ALASKA

Two new coal seams discovered near Anchorage — Commissioner says Alaska needs army of prospectors

★The production of the Evan Jones coal mine near Anchorage will be increased by 150 tons a day according to Harry J. Hill, president of the company. The increased production will result in an output of 450 tons a day. The discovery of two new coal seams four and twelve ft. wide which were crosscut by a 640-ft. rock tunnel at considerable depth, has added an estimated 3,000,000 tons of coal to the mines reserves. The construction of a new and improved tipple and washing plant is planned.

★The Nicola Placer Mines and the Chititu Mines, placer gold properties in the McCarthy district, are being prepared for resumption of mining next year by their respective operators, Jack Price and Charley Kraemer.

★Part of the Wasky Act is held to have been repealed by implication in a measure passed by Congress in 1938, according to a decision handed down by Judge Harry E. Pratt in the Federal District Court at Fairbanks. The Wasky Act provided that the owner of a mining claim would forfeit title to a claim if he failed to do the $100 assessment work in any year. Since the act made no provision for an owner to resume work and reestablish his location, failure to do the assessment work in any one year has been regarded as a permanent defect in the owner's title, leaving the ground open to relocation by another party at any time thereafter, regardless of assessment work performed by the owner in succeeding years.

★D. B. Stewart, Territorial Commissioner of Mines, says an army of prospectors are needed in Alaska to open new gold deposits as well as to prospect showings of several other minerals. Stewart purchased half a million dollars' worth of Alaska metals during the war for the government. This, he says, shows that the mining industry in Alaska has a good future. Gold mining, he believes, will go ahead first and fast as soon as manpower and equipment are available in the early spring. Industrial metals, such as zinc and lead, are sought, but a lack of prospectors retards discoveries. He recommends that the Territory cooperate with private industry to secure prospectors and to educate returning soldiers who have expressed interest in Alaska mining possibilities. He suggests that newcomers be taught to identify minerals.

★Tom Paskvan recently made an exploration trip and examined five

claims which he has on Mastodon Creek, in the Eagle Creek district. He and his partner put down three holes which he says show good pay. In one hole they hit gravel 10 ft. deep on the bedrock, which panned $2.50 per foot.

★United States Smelting, Refining & Mining Co. reports that thaw drilling will be resumed this winter at Chatanika. This work is to start in October with 30 or more men and continue through the winter. Other operations will be resumed in a large way in the spring. Dredge repairs will be made during the winter so that operations can be resumed as soon as possible. How soon this work can get under way depends on how fast old employees return. It is hoped the operations will be at least 75 percent as large as heretofore.

★It is reported that jade in increasing quantities is being found near Kotzebue and that the Eskimos carve it as they would ivory and sell it for curios. Most of the ore found so far is said to be float.

★Boundary Dredging Co. has brought suit against Alaska Gold Placers in the district court asking that two mining claims in the Fortymile be sold to satisfy a $12,000 note given in July 1940. The plaintiff asks for $1,500 attorney fees and the right to purchase the property.

★More than a thousand Alaska and Yukon pioneers were present at the annual discovery day picnic, in Seattle, in August. Bill Euler made a hit with his portrayal of the miner of 1898 on Cheechako Hill, and in the Nome and Fairbanks rushes.

★Santiago Mines, Ltd., a British Columbia company, has acquired a 75 percent interest in the Coral Inlet mine, situated on tidewater a few miles north of Ketchikan, Ala. Some development work has been done on the property, and drifts have opened 1,000 ft. of vein averaging 8 ft wide. Channel samples show free gold.

★A geological and topographical map of the eastern part of the Lower Matanuska Valley coal field has been completed by the U. S. Geological Survey.

★The Lucky Nell Mining Co., incorporated in the State of Washington, has filed with the Territorial Auditor at Juneau. J. J. Matuska, of Ketchikan, is the company's agent. The company has property on Prince of Wales Island, at Hollis, on Kasaan Bay. Ben J. Scott is president, and Franklin Johnson secretary, both of Tacoma.

★A shale bed 50 to 400 ft. thick at the outcrop is probably the source of a large part of the oil in the Katalla field, according to William E. Wrather, of the U.S.G.S. From 1902 to 1933 the field produced about 154,000 barrels of high-gravity paraffin-base oil.

★Dan Lhamon, manager of Northern Commercial Co. at Fairbanks, says it is hoped that miners will be able by November to get mine machinery without priorities. "We are making deliveries according to the order in which orders are received. The WPB revoked L-122 August 20, permitting orders to be filled for civilian users including gold miners."

CANADA

Increased development work under way in Ontario and Quebec —Howe Sound company to develop Snow Lake property

★Activity continues to increase in all established mining camps in Canada. Men demobilized from the armed forces are going North with their families, along with those who had shifted to war work in the industrial centers of Quebec and Ontario. The number of diamond drilling machines in operation has increased considerably. Shaft-sinking operations are in progress, one contractor reporting that he is handling three contracts in the Red Lake district and four others in northwestern Quebec. Reports of favorable drilling results continue to stimulate interest in the Yellowknife camp, Northwest Territories, and in various promising areas across northern Ontario and Quebec. Many companies are well financed to undertake systematic exploration where gold possibilities had been indicated years ago by preliminary work. Established producers, where curtailed operations have been in effect for several years, report a gradual improvement in labor conditions.

QUEBEC

★Malartic Goldfields, in Dubuisson and Fourniere townships, is undertaking a major mine-expansion project for the postwar period. Deepening the No. 2 West shaft to 1,500 ft. is making steady progress, although work continues to be handicapped by labor shortages. Three wide ore zones are under development from the 600-ft. level of the new shaft. Two of the zones have widths of 20 ft., one of them showing average grade of 0.25 oz. for a length of almost 300 ft. The third zone, 10 ft. wide, is being developed. C. O. Stee, consulting engineer, reports that ore indicated and developed on the first three levels, down to the 450-ft. horizon, amounts to almost 3,000 tons per vertical foot. In the section developed by the No. 2 shaft, ore reserves at the end of 1944 were 1,000,000 tons averaging $9.25 a ton. The No. 1 shaft is down to 1,870 ft., and 430,000 tons of reserves have been developed with an average gold content of $6.95 a ton. Milling started at the end of 1939, at the rate of 335 tons a day. In 1940, capacity was increased to 600 tons. The mill was later expanded to 1,000-ton capacity,

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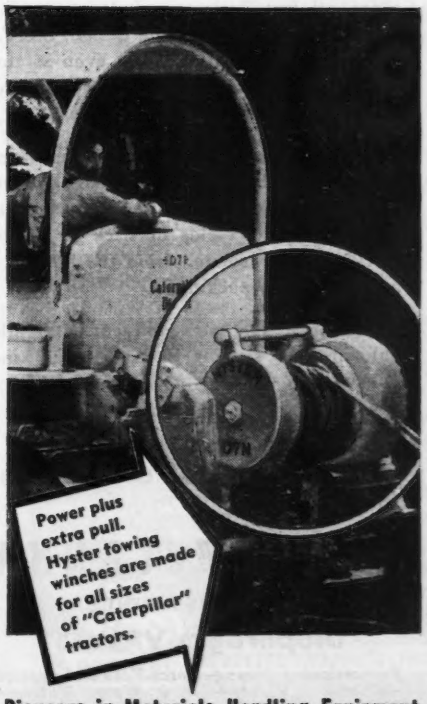

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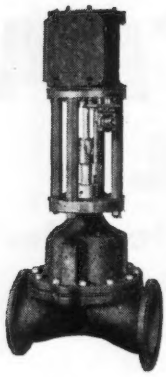

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Canada *(continued)*

but has not yet been used, because of labor shortages.

★Union Mining Corporation has announced plans for drilling the former Auriac and Numaque properties, adjoining the Sigma and Lamaque mines. Geophysical surveys by Koulomzine, Geoffroy Brossard, Ltd., indicated favorable areas outside the ground formerly drilled. Gaps between previous drill holes where interesting values were disclosed will also be tested. The program starting in September provides for upwards of 30,000 ft. under contract with Jones & Bradley, of Kirkland Lake. Paul D'Aragon is consulting engineer and John B. DeMille is acting in a general consulting capacity.

★Shaft sinking is making rapid progress on the property of Anglo Rouyn Mines, as reported by Charles L. Hershman, consulting engineer. The shaft will be put down to 500 ft. and the first station cut at 275 ft. At some distance from the present work, a shaft was sunk by Pontiac Rouyn Mines several years ago. The property adjoins Powell Rouyn on the north. Edwin D. Levinson, of New York, is president.

★The 500-ft. shaft on the Destor Township property of Dequesne Mining Co. is being dewatered preparatory to sinking another 250 ft. The sinking contract has been let to Miners, Inc. Levels will be established at 625 and 750 ft., as reported by C. Glenn Hunter, president. It is planned to build up an ore dump preparatory to mill construction. The company is considering shipment to a customs mill in the early stage of the program. Drill hole No. 47, 200 ft. west of No. 41, is reported to have intersected 23.8 ft. of core that assayed $48.74 a ton. Diamond drilling from surface is not to be continued while shaft sinking is in progress.

★A new drilling program has started on the property of Mylamaque Mines, south of Lamaque Gold Mines, in Bourlamaque Township. George L. Holbrooke, consulting geologist, reports that work is being directed to the northwest part of the ground, supplementing the exploratory drilling of a year ago. Diamond drilling has been done also on Mylamaque properties in Ontario and in the Yellowknife district.

★Arntfield Mining Corporation reports values from $13.86 to $27.33 a ton across widths up to 5 ft. in the first two drill holes exploring the new North vein. There are favorable chances for this structure to intersect the main ore zone below the present bottom level of the No. 2 shaft at 1,075 ft. Crosscutting on the bottom level is to provide drilling stations for deep drill holes below 1,400 ft. H. Buckles is consulting engineer.

★In September, Tiblemont Goldfields started an extensive program of drilling which is following indications secured by a recent geophysical survey. Maurice Scott, of the staff of Sullivan Consolidated Mines, is engineer directing the work. Buffalo Canadian Gold Mines, of which E. K. Fockler is a director, controls the recently organized Tiblemont Goldfields.

★J. P. Norrie, president and general manager of Croinor Pershing Mines, reports that preparations for shaft sinking have been completed on the large property in Pershing Township, 15 miles from the railway. Extensive diamond drilling has indicated upwards of 2,300 tons of ore averaging $10.25 per ton per vertical foot. The orebody has been traced for a length of 1,500 ft., averaging 13.3 ft. in width. Several veins have been located parallel to the main ore structure, and a large part of the property remains to be explored. Present plans provide for a mill having a minimum daily capacity of 500 tons. The company reports $600,000 in the treasury.

★Work on the new road to Lake Chibougamau is well advanced and a third of the 150-mile distance, northwest from St. Felicien, on Lake St. John, is scheduled for completion this December. Authorization is expected to be given by the Quebec Government for completion of the highway, probably sometime in 1947. Some prospecting activity has been in progress in the Chibougamau area for the past year and most of the interesting ground through six townships has been staked. Active work this season has been conducted through the area by Kennco Exploration, subsidiary of Kennecott Copper.

Of the four properties in the area where commercial ore has been indicated, ground held by Obalski Mining Corporation is to get additional work as a result of financing arrangements in progress. Prewar drilling and surface work indicated an average grade of $14.50 a ton in gold, 1.23 percent copper, and low values in silver.

★Karl J. Springer, president of Gwillim Lake Gold Mines, reports $110,000 in the treasury to finance an extensive program. Diamond drilling was to start before the end of September, following a program of shallow holes that was carried out in 1935 by McIntyre Porcupine Mines. At that time a promising ore zone was indicated.

ONTARIO

"The decreasing output of bullion by Ontario's gold mines is offset largely by the remarkable number of discoveries across the breadth of Ontario's pre-Cambrian formation," said Leslie M. Frost, of the Ontario Department of Mines, as he released the accompanying production figures. Mr. Frost pointed out also that claims recorded during the first seven months of the year were greater in number than during the comparable period of 1944 and indications are that last

Canada (*continued*)

year's near record stakings would be eclipsed.

Production in July by 37 gold mines was valued at $4,593,064 from the treatment of 481,596 tons of ore containing 119,151 oz. of gold and 16,276 oz. of silver. These figures are roughly 12 percent lower than those for the comparable period of 1944, both as to tonnage milled and value. The same drop is reported for the first seven months of 1945 against the same period for the preceding year. Output since the beginning of the year to the end of July was valued at $34,036,288 from the treatment of 3,541,448 tons.

In referring to the prospecting activities, the Minister stated that 12,527 claims had been recorded during the whole of 1944 and that the latest available figures from his department showed that to the end of July, 6,965 claims had been recorded. The districts of greatest activity were Sudbury, with 987 claims; Port Arthur, 894 claims; Porcupine, 1,336 claims; Larder Lake, 1,293 claims; Red Lake, 1,412 claims—all recorded during the first 7 months of 1945.

"We know that the prospectors are rushing to areas of new activity, especially in the Manitoba Lake area, the Springpole and Birch Lake area, the Vermilion Lake area, and the Swayze area," Mr. Frost said.

MANITOBA

★Howe Sound Exploration Co., Ltd., now has an office in Winnipeg from which to direct the development of its gold property at Snow Lake. Present plans call for transportation of equipment and supplies from Mile 83 on the Hudson Bay Railway to the property over the ice of Herb Lake during the coming winter, so that sinking of the proposed five-compartment shaft to 1,000 ft. may be commenced early in the spring. George C. Lipsey is manager for the Snow Lake property; Sidney Teal is superintendent, and S. F. Crocker, chief engineer.

★Kiwago Gold Mines, Ltd., has purchased a diesel engine and compressor from Gunnar Gold Mines, and plans sinking a 125-ft. prospect shaft on the Valley vein immediately. The Valley vein is one of a number of known gold-quartz veins on the company's property in the Rice Lake district. Diamond-drilling and surface sampling of other veins continue to yield encouraging results. H. G. Pickard is resident engineer.

★Wekusko Consolidated plans to extend the 160-ft. shaft, sunk by former operators on the Rainbow-Ferro group of claims at Herb Lake, to 1,500 ft. and do 6,000 ft. of lateral work as soon as labor and equipment are available, in order to extend the gold-bearing orebodies found by diamond drilling and limited underground development. G. Brock Tribble is in charge of operations.

BRITISH COLUMBIA

★Taku River Gold Mines, Ltd., which recently purchased the Polaris-Taku mine, Atlin mining division, is considering an increase to 500 tons daily in milling capacity, following preliminary metallurgical tests which have indicated an improvement of more than one dollar per ton in gold recovery. W. B. Milner, president, says the company intends to extend the present shaft from the 450-ft. horizon to an additional depth of 300 ft. to provide for two more levels. This, it is expected, in view of the favorable experience on the bottom level, where both width and grade of veins materially increased, will add substantially to the estimated ore reserves, now well in excess of 300,000 tons. A party consisting of A. W. Carr, W. H. Englebright, and W. B. Milner, directors; William Dunn, consulting metallurgist; and Dr. G. C. McCartney, consulting geologist, visited the property last month. A crew under Frank H. MacPherson, general superintendent under the former operation, is preparing the property for early resumption of production.

★Net smelter returns of Silbak Premier Mines, Ltd., for July were $41,549. Recovery was made after treatment of 5,415 tons, averaging 0.20 oz. gold and 1.66 oz. silver per ton. Operating loss before write-offs was $1,000.

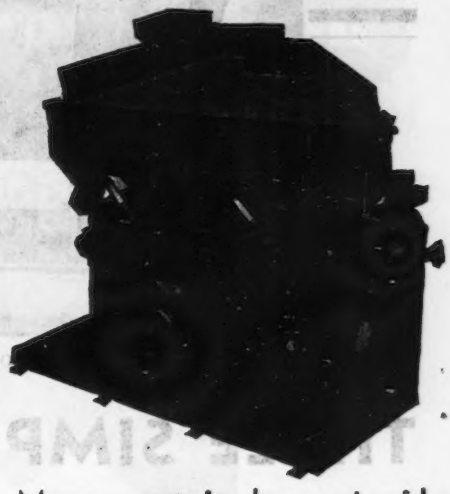
★During the first half of 1945, Silbak Premier Mines, Ltd., treated 1,468 tons of ore mined in the Northern Light claim of Premier Border Gold Mining Co., Ltd., Portland Canal mining division. This resulted in a net profit of $3,494, which was placed to the credit of Premier Border, reducing total indebtedness to Silbak Premier to $7,308. When all advances shall have been repaid the Premier Border company will receive 40 percent of profits.

★Salmon Gold Mines, Ltd., Portland Canal mining division, reports the intersection in diamond-drill hole No. 2 at a length of 513 ft. of 5.5 ft. of vein material averaging 0.63 oz. gold per ton. The mineralization extends for 8.5 ft., but the remainder carries little more than a trace of gold. The core was obtained at a horizon approximately 100 ft. above that on which Consolidated Mining & Smelt-

Ontario Production January to July, 1945, Inclusive

Field	Tons Milled	Value	Gold, Oz.	Silver, Oz.
Porcupine	2,064,171	$18,590,408	482,041	85,576
Kirkland Lake and Larder Lake Belt.	941,029	10,252,162	266,017	47,301
Matachewan and Sudbury	178,918	609,579	15,795	3,855
Northwestern Ontario	357,330	4,583,156	119,122	10,705
Miscellaneous	.....	983	26	2
Total	3,541,448	$34,036,288	883,001	147,439

SLAGS SKIMMINGS, RESIDUES?



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TYPE UA WITH MOTOR AND V-BELT DRIVE is a compact, efficient unit that fills the bill in many laboratories where an independent power unit is desired.

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Canada *(Continued)*

ing Company of Canada, Ltd., found two promising veins during its last work on the property. The holes are being driven above the earlier discovery to prove the 525 ft. vertically to showings on the surface thought to be from the same vein.

★On the advice of its consulting geologist, Charles C. Starr, Santiago Mines, Ltd., will commence a diamond-drilling program at the Holland property, upper Bridge River Valley, recently acquired on option from New Holland Gold Mines, Ltd. First holes will be driven from the southwestern end of the Langdon claim in an attempt to intersect the contemplated extension of the Bralorne's productive "51" vein.

★Pinebrayle Gold Mines, Ltd., will drift on a vein on its Peru No. 3 claim, situated across Cadwallader Creek from the Bralorne mine. The vein has been traced on the surface for more than 400 ft. and has averaged 3.6 ft. wide and $8.50 per ton in gold. A diamond-drill hole driven in the Ogden claim has shown the sedimentary argillites to be merely a capping, extending only to a depth of 39 ft. Below this a length of quartz porphyry was encountered, followed by a section of highly mineralized quartz diorite.

★An intersection of high-grade ore has been obtained by Olympic Gold Mines, Ltd., lower Bridge River Valley, at a length of 143½ ft. in its first diamond-drill hole. An indicated true width of 4 ft. assays 1.04 oz. gold and 11.8 oz. silver per ton, equivalent to $45.35. A second hole has intersected 9 ft. of highly mineralized material 170 ft. to the northwest, and this is thought to indicate a continuation of the vein. Next hole will be driven with the intention of intersecting the vein at 100 ft. greater depth.

★Taylor Windfall Gold Mines, Ltd., has been granted permission to sell 500,000 treasury shares to obtain money for development of its Taseko Lake property, Clinton mining division. The decision to resume development was made after receiving a report on a recent examination by E. S. Mason, consulting engineer.

★With underground labor continuing in very short supply due to the rush to stake placer leases in the adjoining territory, production of the lode mines in the Cariboo mining division was again disappointing in August, when the Cariboo Gold Quartz Mining Co., Ltd., produced only 670 oz. gold, valued at $25,795, from 1,962 tons, averaging 0.34 oz. gold per ton. For the first time in its history, the monthly output of Island Mountain Mines Co., Ltd., Newmont subsidiary, operating across Jack of Clubs Lake, was higher at 757 oz. gold, valued at $29,162, from 1,723 tons, averaging 0.44 oz. gold per ton.

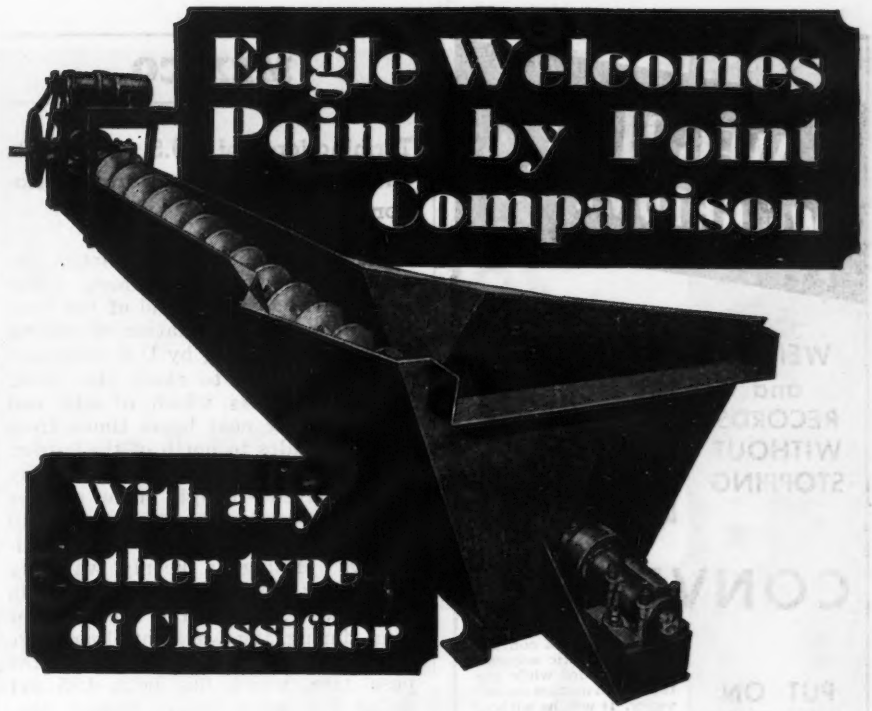
★Hedley Mascot Gold Mines, Ltd., Osoyoos mining division, has made payment of its third installment on the purchase of the Wheeler group of mineral claims on Nickel Plate Mountain. With only a limited amount of development work done, 30,000 tons of high-grade ore is reported to be readily available on the surface. The ore is being trucked at the rate of about 35 tons daily to the Canty bunkers, whence it is trammed to the Mascot mill for treatment. The Mascot company has taken an option for $50,000 on the Night Hawk No. 7 claim, adjoining the Wheeler group.

★During the same fiscal year, the wholly owned subsidiary Zincton Mines, Ltd., produced 16,755 tons of concentrate containing 19,379,566 lb. zinc from 102,457 tons of ore treated. Income from production was $710,197, and from other sources $3,911. Operating expense was $350,927. After provision of $23,951 for depreciation and depletion, and $83,381 for taxes, net profit for the year was $255,849, equivalent to $2.50 per ton of ore milled. Development work consisted of 317 ft. of drifting, 335 ft. of raising, 21 ft. of incline, and 10,587 ft. of diamond drilling. Zinc ore reserves showed little change and at May 31 were estimated at 186,820 tons. The company's contract with the U. S. Government agency expired May 31, and no renewal is expected. This, combined with a glut at United States smelters to which Zincton concentrate is shipped, necessitated a temporary suspension of production, during which time development is being advanced and all machinery and equipment are being overhauled. The annual meeting of shareholders was advised by H. E. Doelle, managing director, that operation could be continued profitably at the present market price.

★Bayonne Consolidated Mines, Ltd., Nelson mining division, will sink a winze to a depth of 200 ft. on the "A" vein from the 8A West drift. Every preparation is being made to resume production as early as possible in 1946. A new Caterpillar has been purchased, roads are being regraded, mine and camp are being rehabilitated and reconditioned, mine timbers have been cut, wood and oil fuel are being transported to and stored at the mine, and powder and cyanide have been purchased.

YUKON TERRITORY

★The importance of mining in postwar rehabilitation is clearly indicated in the request of Yukon Consolidated Gold Corporation, Ltd., to National Selective Service for 500 additional workers. The company owns nine dredges, of which only three are being currently operated. The curtailment of development work, necessitated because of the labor shortage situation, will prevent immediate resumption of full-scale work, which C. E. McLeod, secretary, estimates cannot be achieved for a minimum of two years.



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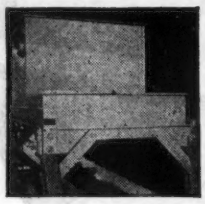

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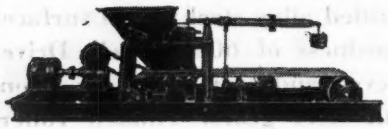

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MEXICO

Termination of U.S. contracts causes concern—Rail transportation improves

★Mid-fall found uncertainty increased for Mexican mining. The abrupt arrival of the end of the war, and impending cancellation of mining products purchasing by U.S. interests, have not served to cheer this basic Mexican business, which, of late, had been enjoying near boom times from extensive sales to north of the border. Currently, mining labor is generally well behaved—though some sources fear fresh restlessness soon—and rail transportation has improved considerably. Mining is keenly watching foreign exchange, eager to ascertain just how heavy imports, even heavier than during the war, entailing huge expenditures abroad will affect the peso rate, which has been 4.85 per dollar for some time. Mining contends that it just gets by with its foreign trade at that peso-dollar rate.

President Camacho had the following candid things to say about the mining situation during the year ended Aug. 31 in his message at the opening of the new Congress on Sept. 1:

"The ending with the United States of contracts for the sale of our metals, at a time when the pressure of war considerably diminished the buying of them, profoundly affected our mining industry. Statistics (unquoted) demonsrate that the situation is not encouraging. Mining production decreased in 1944 with regard to the previous year, not only of precious metals but also of industrials. Besides the decrease in purchases abroad of our metals, other factors contributed to this decreased production: the irregularity of transportation that occasioned the accumulation of ores in mining centers; the suspension of work by small enterprises because it was unprofitable, and difficulties in the matter of reconditioning equipment.

"Confronted with this situation and remembering that in other times this industry was a very important source of wealth for our country and that it can continue being so, the Federal Government is making careful studies to seek solutions of its present situation. Among these studies are those for the intensification of exploitation, not only in existing mining districts but in those that up to now have not been worked; a move to reform some juridical concepts of our mining so as to put them into practice and eliminate obstacles to its progress, and, in general, the tendencies to foment investigations that are intended to improve mining technique."

★Discovery of a rich gold and silver vein near Pachuquilla, Hidalgo mining town, is reported from Pachuca, the Hidalgo capital. Pachuquilla is five kilometers from Pachuca. According to the reports, the Cia. Minera de Real del Monte y Pachuca, S.A., which has operated for long at Pachuca, will soon start working the vein.

★Guanajuato miners have asked the state government to encourage and aid systematic exploitation of the La Luz district deposits, which they declare to be rich but which have been worked only off and on and by haphazard methods. The miners say that thorough, modern exploitation of La Luz tracts would go far toward relieving depressed conditions in Guanajuato mining.

★The quick knocking out of Japan and the large copper stockpile in the U.S. has alarmed the red-metal division of Mexican mining, which is moving to ask the Government to aid it in the form of finding new markets. These circles have a hope that new uses for copper in industry will be a solution to their problem.

★Mining and other labor organizations have asked President Camacho to back their petition to the Federal Congress that it pass a bill making permanent the wartime emergency law, enacted on Oct. 1, 1943, that makes mandatory the hiking of the daily pay of all contracted workers in Mexico who earned up to 10 pesos ($2.10). The laborites told the President that making this law permanent is a vital necessity in view of the still high and increasing living costs in Mexico. Both the law and the proposition to make it permanent directly affect mining employers. Many of them have obeyed the law, but others continue to fight against that, and others have been excused from obeying it as they convinced the Labor Ministry that if they did so they must cease operations.

★Rail transportation for mining has better prospects of improving as the National Railways, Mexico's largest railroad, has announced that it is placing more rolling stock at the service of the industry and issued orders that cars used by the major mining companies be given right of way over all but the most preferred freight, excepting foodstuff and prime necessity articles. The Railways expects to take more deliveries of locomotives and cars from the U.S. soon.

★Two old and important Chihuahua mines near San Pedro de Corralitos, the Congreso and Leon, are now under the banner of the Minas de Durango, S.A. de C.V. (Eagle-Picher subsidiary). Lease and option to these properties was sold to Minas by J. H. Blackwell, El Paso, Texas, mining man, who worked the mines for some ten years. Minas is pumping water from the mines and will soon start exploitation at the initial rate of 100 tons daily, with an ultimate mark of 300. From above the water

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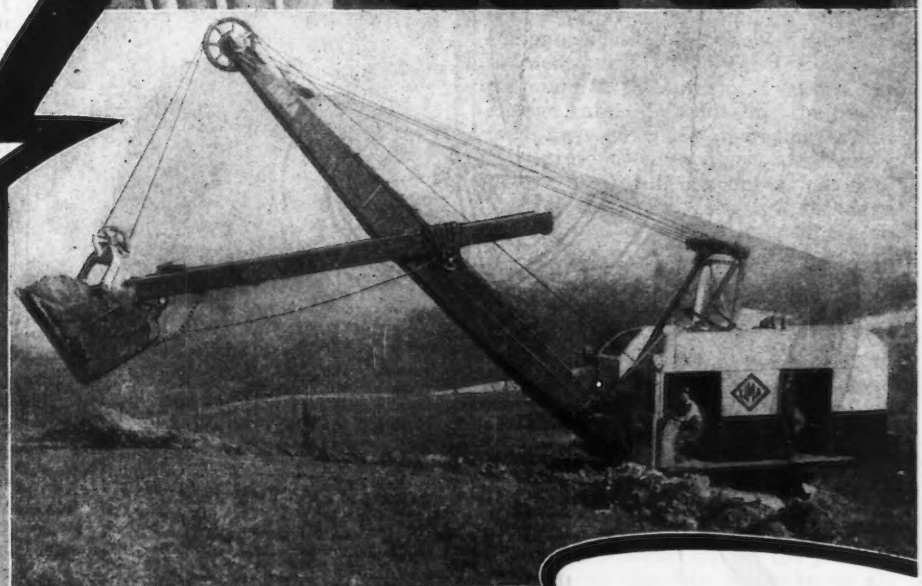

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Mexico (*continued*)

level alone, Blackwell obtained around 65,000 tons with gold, silver, and lead values. His ore was treated at smelters in Mexico and El Paso.

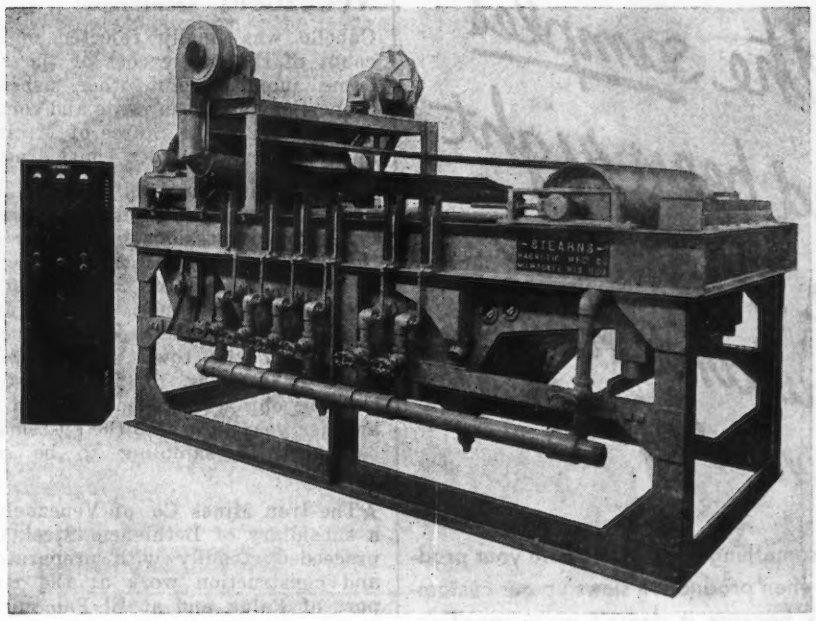
★Worry in the industrial sector of mining about the prospect of Metals Reserve cancelling contracts it made for war supplies with Mexico is reflected in a review of the current business situation in Mexico by the Confederation of Chambers of Commerce. The review reports this sector of mining as expecting the ending of these highly profitable contracts will force it to curtail operations sharply, with the resultant sharpening paring of working personnel, which, it anticipates, will provoke fresh labor trouble in the industry.

VENEZUELA

New Goldfields averts shutdown of Columbia mine—International Nickel field party examines concessions

★During the first six months of the year some improvement in the gold-mining areas was reported. The New Goldfields of Venezuela, Ltd., has maintained its output at slightly above last year's average but is mining ore in the Caratal Unit of submarginal grade to prevent the rapid extraction of the only remaining high-grade ore available in the Laguna mine. Work on the Level 4 West, exposed 870 ft. of 29.6 dwt per ton ore. A winze being sunk from this level to No. 5 level exposes continued high-grade. Developments in the Caratal unit above the main haulage tunnel connecting the Union-Sosa-Mendez Mines have been somewhat disappointing. The New Goldfields has taken over under contract the operation of the Columbia mine of the Compañia Francesa de la Mocupia, which had developed serious mill and power plant troubles because of lack of spares. This action has prevented the shutting down of the richest mine in the district and has enabled the New Goldfields to cut back on marginal ore from the Caratal unit. The output is being maintained at about 2,200 tons per mensem with the grade running from 14 to 15 dwt/ton. This ore is being treated at the New Goldfields Mill 2 miles away and is transported by truck to Caratal and from there by rail to El Peru. The mines have been receiving sufficient rock-drill spares, dynamite and cyanide but the power-plant at El Peru is badly in need of spares and is operating at low efficiency despite a record of careful maintenance in past years.

★In the region of El Callao another small mine, the "Tomi," has been reopened by local miners who have con-



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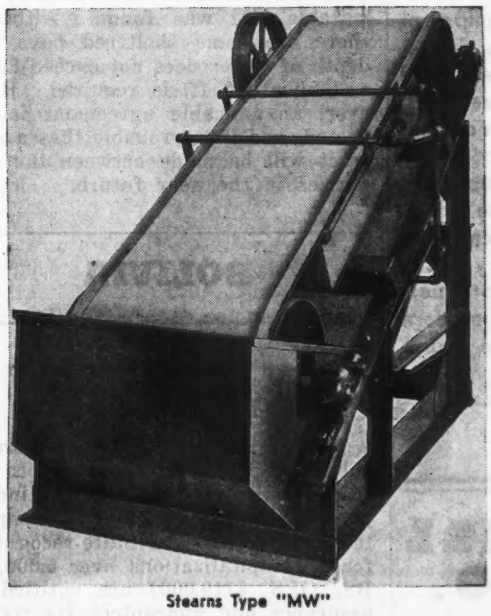

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tinued work on a quartz lode varying from 4 to 5 ft. in width and reported to average 15 dwt/ton in gold. During June a new alluvial gold strike was reported at an uninhabited place named Turumban, in the region between the town of Tumeremo and the Rio Cuyuni, and a minor rush resulted. No details are available yet of this deposit, as it is in a rather inaccessible area.

★During March and April a number of miners left the Rio Pao diamond alluvials to work on a rich gold alluvial near the San Luis de Caroni mine, west of the Caroni River and not far from San Pedro de las Bocas village. About 500 men worked on this find for three or four months and soon gutted the richer portions, which were subsequently reported to be on a quartz lode concession belonging to a local syndicate.

★The demand for gold by local jewelers has increased considerably during the past three years and an appreciable export trade in gold, pearl, and diamond jewelry is developing. During 1944 the Government granted licenses for the exportation of gold jewelry totaling 86,527 grams (2.800 oz.) in weight and valued at Bs 593,743 ($180,000).

★It is known that the gold-mining companies have approached the Government with a request for a gold premium in the form of a special exchange rate. Without this the mines may have to cease operating, as at the present time they are barely paying operating expenses. A substantial premium (say an exchange rate of 5. Bs.—instead of 3.35 Bs. to the $U.S.) would enable them to mill a large tonnage of ore of five to 8 dwt. per ton grade, which cannot now be mined at a profit.

★The Government on June 29 decreed a new area on the Rio Kukenán in the Gran Sabana, to be open for work by the system of "libre aprovechamiento" (free avail), and as a result many miners have left the Rio Surukun field.

★No new major finds of gemstones have been reported during the past six months but the Rio Kukenán is already proving a remunerative field, and the number of miners on the Surukun field has been reduced to less than three hundred.

★The number of registered gold and diamond buyers in Venezuela has been considerably increased since 1944.

★The asbestos mill of the Compañia Minas de Amianto de Tinaquillo, at Tinaquillo, State of Cojedes, went into production towards the end of July and after a few minor adjustments began increasing its through-put and it is expected to reach capacity by the end of September. Work is proceeding on the construction of a cement-asbestos products factory in Caracas which will use the low-grade fibers. The site tentatively selected at Puerto

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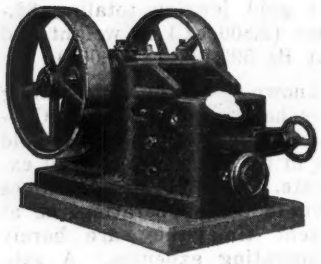
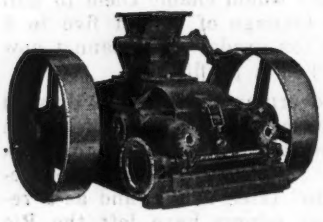


Laboratory Jaw Crusher



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Venezuela (*continued*)

Cabello was finally rejected on account of the heavy cost of the site. Some inquiries for other asbestos properties have been made and certain concessions in the States of Miranda and Cojedes are under consideration.

★The International Nickel Co. has had a field party at work continuously on the concessions held under option in the region of Lomo de Hierro, on the borders of the states of Aragua and Miranda. During July work was started on other concessions near the town of Tinaquillo, State of Cojedes. It is understood that the option has been extended for another year to enable the systematic campaign of sampling to be concluded.

★The Iron Mines Co. of Venezuela—a subsidiary of Bethlehem Steel, has proceeded steadily with preparatory and construction work at the river port of Palua and at El Pao mines. Houses for Venezuelan laborers and staff at the latter camp and a loading plant are being constructed. The Venezuelan Congress has requested the Government to consider the possibilities of the Iron Mines Co. finding a suitable port in Venezuelan waters and a commission was set up in July to examine the coast line in the Gulf of Paria and on the north coast of the Peninsulas of Paria and Araya. It was the intention of the company to transport the iron from the Orinoco River port at Palua in flat-bottomed ships of 6,000 tons' capacity to the British island of Gasparillo, off Trinidad, and there transfer it to ocean-going freighters of 25,000 tons' capacity. The company made a thorough study of the Venezuelan coast within the Gulf of Paria, but no suitable site was found. Although there are some sheltered bays, the depth of water does not exceed 20 ft. and about 40 ft. is required. However, an amicable agreement is expected, and it is probable that a contract will be made between the two parties in the near future.

BOLIVIA

President proposes new act to encourage foreign capital

★On Aug. 30, President Villarroel submitted to Congress an act to attract foreign capital to develop industry and commerce in Bolivia. Important points are: The State recognizes foreign capitalizations over 5,000,000 BS. (U.S. $119,000) are entitled to assurance and guarantees for return by means of annual amortizations, as well as return of profits obtained within the limits and under the conditions established by the proposed act. The project refers to new capital

for a variety of purposes, new enterprises, and the expansion of existing ones. Investments are to be made in foreign currency. In every case the State will fix conditions of incorporation, amortization and return of profits. Profits can be withdrawn up to 15 percent per year. Amortization rates are to be no higher than 20 percent annually. After many statements made by the Government regarding the protection and guarantees that the State offers to extend to foreign investment and capital, this last project represents the most concrete effort to attract foreign investors.

★The Government has authorized Banco Minero de Bolivia to sell gold for dentistry at the price of 70 bolivianos per gram ($1.67 U.S. at official exchange).

AFRICA

Two large financial companies announce alliance—Rand and Transvaal gold production reported

★The Anglo American Corporation has issued the following statement: "The Anglo American Corporation of South Africa, Ltd., which is largely interested in African and European Investment Co., Ltd., announces that negotiations are taking place with the object of substantially increasing this interest. It is anticipated that these negotiations will be completed in the near future, and while there is no question of an amalgamation of the two companies, the effect will be that Anglo American Corporation and African and European and their subsidiaries will operate in closer association. A further announcement will be made when finality has been reached." This official statement bears out suggestions which have been made in recent weeks that the foundations were being laid for a closer working alliance between these two large financial companies.

★The African and European company has proved the existence of gold-bearing reefs over a long stretch of ground southwards from Odendaalsrust, in the area commonly referred to as Block 7. Boring has also taken place on a number of other farms and the results have been made known from time to time. Immediately adjoining the African and European Block 7 area is the ground held by Western Holdings. The controlling interest in Western Holdings passed to the Anglo American Corporation on its acquisition in 1942 of the share holdings of the estate of the late Sir Abe Bailey. Through Western Holdings, Anglo American hold a substantial share in the proved Free State area. This is apart from the wider interests held by Orange Free State Investment Trust. Borehole results

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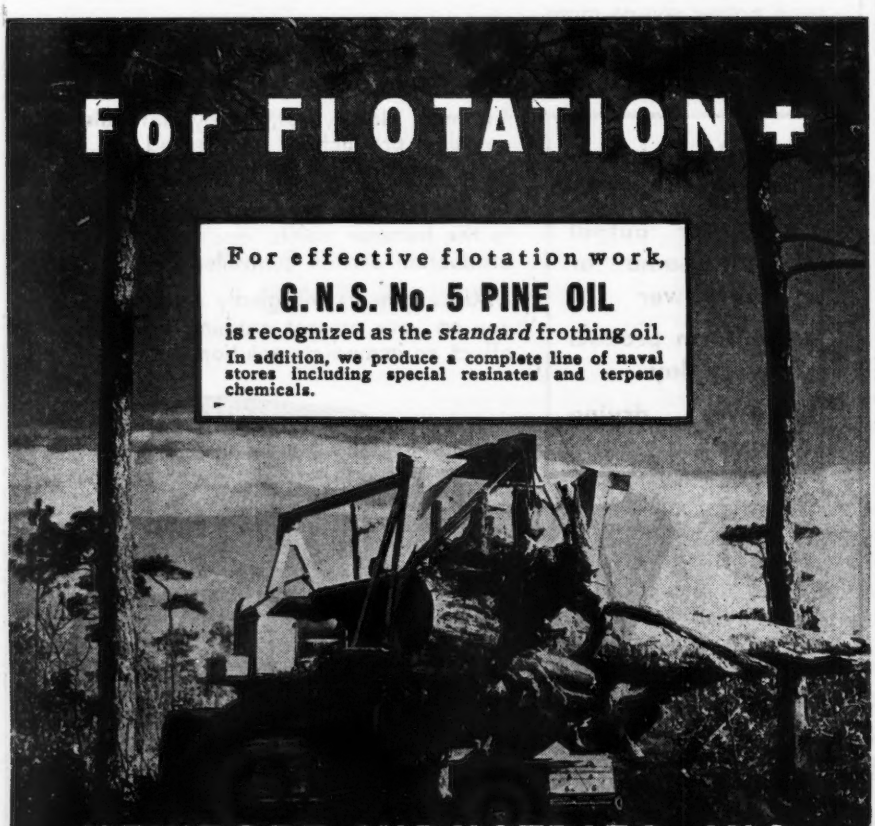

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Africa *(continued)*

on the Western Holdings ground has been indicated that the area is underlain by gold-bearing reefs. The farms in the Western Holdings area are today well known, and some high values have been struck on St. Helena.

Technical difficulties are expected to be encountered in the Free State when the first steps are taken to develop new mining properties. Heavily faulted ground lies between Western Holdings and the southern portion of Block 7, and it is suggested that development can best be proceeded with if comprehensive plans can be made for the whole of the areas in which the new mines are likely to be established. Clearly, it can be to the benefit of both companies if a broad, all-embracing survey can be made of all requirements.

★It is announced that cabled advice has been received that the May output of Tanganyike Diamond and Gold Development Co. amounted to 2,200 carats.

★Mercury ore has been reported discovered near Mombasa, in Kenya, but as at present developed the deposit is not large enough to justify exploitation save in exceptional circumstances. Reports of the occurrence of mercury in Portuguese East Africa have also been received.

★In May 38 lives were lost in mine accidents on the gold mines of the Witwatersrand and its extensions, and this number represents a death rate of 1.30 per 1,000 employes per annum, with the number of employes at 351,395. Of the 38 deaths, 13 were caused by falls of ground and 7 by explosives. For the five months to May 31 the fatality rate has been 1.56 per 1,000 with the highest rate 1.82 in March (53 deaths) and the lowest 1.24 in February (35 deaths).

★A large gold mining company, it is reported, is in the process of formation for the development of Strathmore farm, three miles from Kerksdorp, and the northern portion of the farm Nooitgedacht on which most encouraging drilling results have been obtained. Nooitgedacht adjoins Western Reefs. It is also stated that the New Klerksdorp Gold Estates mine and the eastern townlands of Klerksdorp will be included in the new company. Eastern Rand Extensions, Ltd., which has recently been showing a great deal of activity in the Klerksdorp and Wolmaransstad districts, is understood to be substantially interested in the proposed company.

★The first diamond drill in the Verkeerdevlei area is being erected on the farm "Papiesvlei" about 7 miles south of Verkeerdevlei on the Thaba Nchu-Verkeerdevlei road. It is expected that a second boring machine will soon be put into operation a few miles directly east of Verkeerdevlei. At Leeuspruit, about 10 miles further east, the presence of gold was dis-

covered some time ago. The indications of gold deposits in this district are said to be promising.

★Nessina (Transvaal) Development Co., Ltd., despite increasing difficulties, continues to develop its copper properties in the Transvaal with profit. High-grade ore has been disclosed in the lowest levels of both Harper and Campbell mines. Ore reserves are now 2,742,450 tons, assaying 2.17 cu. ft. and compare with 2,747,730 tons assaying 2.19 cu. ft. for the previous year.

★The total quantity of rough and uncut alluvial diamonds produced in the Transvaal during the month of May 1945 was 2,045.5 carats, valued at £12,017. This is equal to £5.17.6d. a carat.

★Plans to reopen the Premier Diamond mine were reported by the chairman at the annual meeting. Pumping operations to dewater the mine were commenced on Feb. 22 of this year, and are proceeding satisfactorily. It is estimated that approximately a thousand million gallons of water will have to be pumped before the mine is sufficiently dry for mining operations, and that it will take at least eight months' continuous pumping to achieve this. The technical staff consider that, due to the depth of the workings, the open-cast method of mining is now unsafe, and it has therefore been decided to work the mine by underground methods. Plans are well advanced for the sinking of the necessary shaft for this purpose to 1,300 ft. which will permit the satisfactory working of the mine to approximately 1,000 ft. The design of a modern washing plant, capable of treating 8,000 loads per shift, is well in hand, and it is estimated that production will equal approximately 70,000 carats per month when this plant is working at full capacity. It is expected that full-scale production will commence within approximately two years. The cost of re-equipping the mine will be high, due, as a result of the war, to the increased cost of labor and mining requirements of every description. Detailed estimates have not yet been completed, but it is certain that not less than £1,000,000 will be required for capital expenditure and a further £200,000 to meet working costs until the first production can be sold."

★At the annual meeting of De Beers' Consolidated Mine, it was announced that intensive research will in future be conducted into the uses to which industrial diamonds can be put. Allied with this will be research into the properties of different types of industrial stones, with the object of making the best possible use of them. In this way the use of industrials will probably be stimulated considerably, with beneficial results to the industry.

★The value of Transvaal gold production in June is based on 172s. 3d. an

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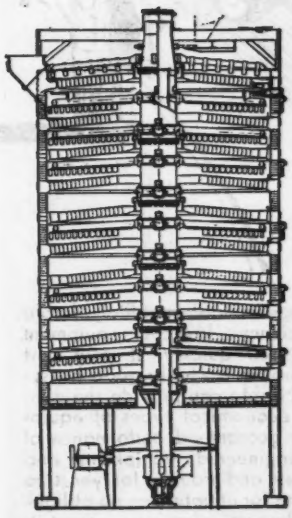

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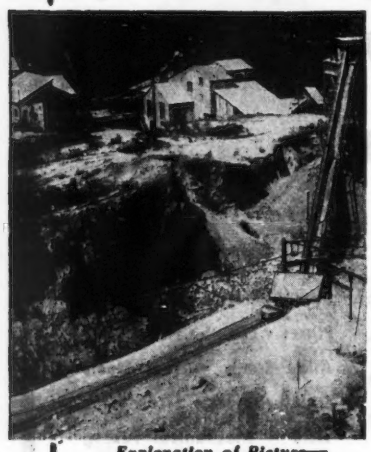

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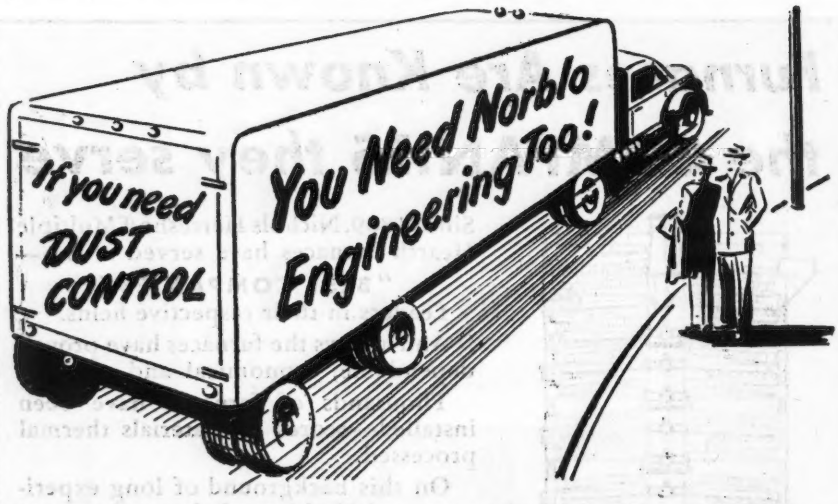

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Africa (*Continued*)

ounce fine, compared with the May declaration of 168s. an ounce. This accounts for the anomaly that while June return, issued by the Chamber of Mines, shows a reduction in the Transvaal output compared with May, the value of the lower output is higher. June production amounted to 1,024,796 oz., a decrease for the month of 6,194 oz., but the value, on the new basis of £8,826,055, showed an increase over May of £165,739. Witwatersrand production was 6,181 oz. lower at 1,002,071 oz. and the value £161,019 higher at £8,630,336. The return from outside districts at 22,723 oz. showed a decrease of 13 oz., and an increase in value of £4,720 at £195,719.

Of Witwatersrand producers last month the principal increases shown were: Daggafontein 889 oz., Simmer and Jack, 699 and Grootvlei, 444. The main decreases were Van Dyk 1,848 (operations affected by underground fire); Langlaagte, 1,327; Rand Leases, 1,176; Modder East, 683; Crown Mines, 677; E.R.P.M., 653; Van Ryn Deep, 650; Randfontein, 634; Durban Deep, 592; Venterspost, 576; Nourse Mines, 558; and West Rand Cons., 511.

Details of June gold production in comparison with May are as follows:

	May Oz. Fine	June Oz. Fine
Witwatersrand	1,008,252	1,002,071
Other Districts	22,738	22,725
Totals	1,030,990	1,024,796

Value at 172s. 3d. an ounce fine for June, May 168s.

	May £	June £
Witwatersrand	8,469,317	8,630,336
Other Districts	190,999	195,719
Totals	8,660,316	8,826,055

★Transvaal gold production for January to June, 1945, inclusive was 6,115,726 oz., compared with 6,128,950 oz. for the first six months of 1944, a decrease of 14,224. This decrease has been sustained despite the fact that in the early part of 1944 the operations of many companies were for a considerable period affected by the flooding.

AUSTRALIA

Increased gold price expected to benefit mining—Huge Tasmanian tungsten deposit diamond drilled

WESTERN AUSTRALIA—

★Paringa Mining & Exploration Co., Ltd., is situated near the center of the Kalgoorlie gold field. Though an old company, it did not attain promi-

nence until it resumed active operations about 1934. Not only has it developed and equipped its original group of leases, but it has given close attention to a number of contiguous old and abandoned leases to the northward, on which work to date has shown that investigation is warranted. These leases were worked to shallow depths prior to 1900, and after preliminary work by the Paringa company, the Mt. Charlotte group is now under option to Wiluna Gold Mines, Ltd. Work has been delayed by manpower restrictions, but the Wiluna company has recently moved its mining plant to Kalgoorlie, preparatory to commencing exploration. Diamond drilling by Paringa Mining & Exploration Co. had indicated over 1,000,000 tons of ore with an assay value exceeding 5.0 dwt. gold per ton. Following the arrangement of the Mount Charlotte option, the Paringa company took up the Maritana group of leases to the south, and diamond drilling has located lodes from 12 ft. to 20 ft. wide at depths of 800 and 1,000 ft. carrying values approximating 6 dwt. gold per ton. Working its main mine, the company treated 66,055 long tons of ore in the last financial year. The head value was 5.1 dwt. gold per ton and the mill recovery 88.03 percent. In the year development was limited to 2,626 ft., against the usual prewar figure of 5,000 ft., and the total arrears in development are now 7,000 ft. An eastern series of ore channels, hitherto unexplored, is being investigated by diamond drilling. Ore reserves are estimated at 277,045 long tons of an average grade of 5.8 dwt. per ton.

★Following the increase in the price of gold of 4s. 3d. sterling per ounce by the British Government, there has been an increase in the Australian price to £A10-15-3 per ounce. The rise in price is cheering to the gold-mining industry. In Western Australia the increased price is expected to provide more employment, and additional low-value mines may be brought into production. A number of mines has been kept in order during the war period, following their closing down. Maintenance has been financed by a Government grant of £A100,000 so that these mines can resume operations when men are released. It is hoped to employ 10,000 men in the mining industry in the State within the six months following V-J-Day. A considerable number would also find indirect employment in industries contributing to mining. Since the Commonwealth Government introduced the tax on gold in 1939, the Federal Treasury had received more than £A3,000,000 from this source. The increase in price would mean further revenue to the Commonwealth Government.

TASMANIA

★Production has commenced on the mine of King Island Scheelite, N.L., on King Island, in Bass Strait. A

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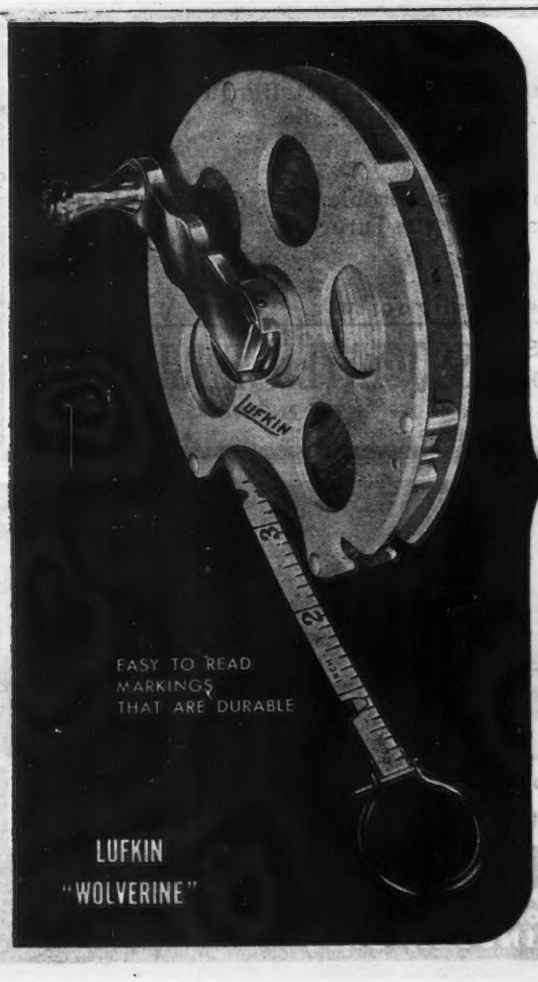

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Australia *(continued)*

systematic drilling campaign has established the deposit as probably the largest scheelite occurrence in the world. To increase the production of tungsten during the war, the Commonwealth Government became interested in the expansion of the company's operations. The Government's estimate for the cost of exploration, mine development, and the erection of a mill with a capacity of 20,000 tons of ore per month was £A260,000. Control of operations was then assumed and expenditure has now reached £A520,000, for which indebtedness the company is responsible. Potential production of the new mill is about 100 tons of scheelite concentrates per month, which is in excess of the possible market. The company's agreement with the Government provides for the purchase of the full output of concentrates by the Government for a definite period. The Government has proposed a reduction to half the plant capacity, but the proposal has been refused by the company so that the financial benefit from full production will be assured for the term covered in the agreement. Only a small part of the company's property has so far been explored by diamond drilling, and the estimate of payable ore within this area is 1,293,000 tons having an average assay value of 0.75 percent, WO_3, there reserves being overlain by 917,400 tons of rock overburden and 227,000 cu. yd. of sand. The quarry is worked in six benches, each of 20 ft. vertical height. Three main arterial roads connect with the 50 ft., 110 ft., and 150 ft. benches, and lead to the crusher section of the treatment plant, all material being mechanically loaded and transported by motor truck to the mill.

Orebodies occur in slates and quartzites intruded by narrow veins of aplite, with granite in the near vicinity. The orebodies conform in strike and dip with the enclosing rocks. The scheelite is confined to a bed of garnet-hornfels carrying subordinate quartz and calcite. Minor sulphide minerals, includying molybdenite, are present in the ore. Concentrates are at present being produced from the gravity section of the mill only. The flotation section will soon be in commission.

NEW ZEALAND

★Extensive deposits of iron sand occur at a number of places on the New Zealand coast. On the west coast of the North Island and the west coast beaches of the South Island there are large occurrences. Accurate estimates of quantity have been made at one locality only. This is at Patea, on the west coast of the North Island, where a five-mile radius

west and a ten-mile radius east contains 45,000,000 tons of iron sand assaying 21.1 percent iron, which, by magnetic separation, should yield 14,000,000 tons of concentrate assaying 53.4 percent iron. Other areas contain large reserves of workable iron sand. Many attempts have been made to smelt these sands but all have failed, either for technical or financial reasons. Analysis of magnetic concentrate showed 53 to 60 percent Fe., 8 to 10 percent TiO_2, and 0.3 to 0.5 percent V_2O_5.

How Frothers Help or Hinder Flotation

(*Continued from page* 95)

ner, assistant professor of geology, School of Mines, University of Idaho, using a special technique. The technique involved inserting a 500-cc. dispensing burette, open end downward, into the operating flotation cell. See Fig. 3. The aërated water to be observed and photographed was lifted into the burette by applying a vacuum (using the mouth) to the valve end of the burette. The bubbles were brought to a standstill by releasing the vacuum to allow the aërated column to fall back into the cell at a rate that just balanced the rise of the bubbles.

From the data given, it is easy to see the progressive decrease in size of bubbles with increase in concentration of pine oil. This fact, of course, indicated that surface tension is diminishing. It is interesting to note, particularly in Figs. 3a and 3b, that some of the bubbles are elliptical and some are round. It was observed that the bubbles are not constantly spherical as they rise, but are alternately compressed and elongated on their vertical axes. The bubbles that appear as spheres were photographed in their nearly expanded position; those that appear elliptical were caught in the compressed state. The smaller bubbles of Fig. 3c do not noticeably undergo these contortions.

To ascertain if frothers, in the minute quantities used in flotation pulps, have any effect on power drawn and aëration produced, certain tests were made the results of which are given in Table I. It is evident that, with all other physical factors constant, power input to a flotation machine falls off slightly and uniformly with increasing additions of pine oil, and that aëration likewise decreases. It was noted, too, that "density" of the aërated water decreases, or put another way, the percent of air content in-

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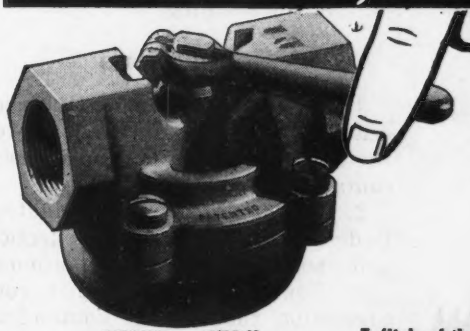

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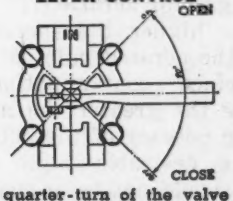

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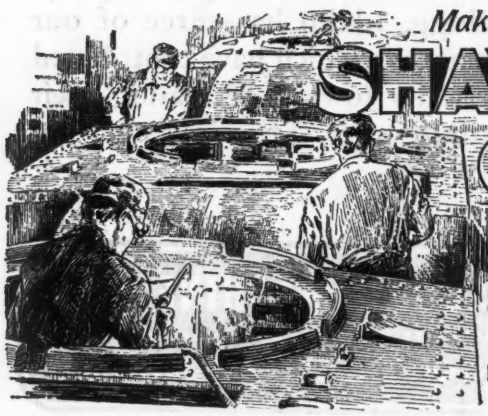

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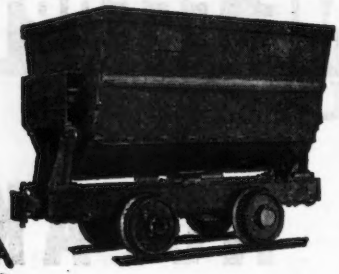

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Frothers *(continued)*

creases, with increase in pine oil.

A satisfactory explanation for the relationships involved is not readily forthcoming.

Conclusions

1. Frother reagents, in the concentrations used in practice, lower the surface tension of, and thereby contaminate, bubble surfaces.
2. Bubble surface contamination is detrimental to mineral collection and should be held to a minimum.
3. For any given frother concentration the surface contamination is related to the specific surface (degree of aëration).
4. The higher the specific surface of the aërated pulp, the lower the surface contamination and therefore the greater the mineral-collecting potency of the bubbles.
5. The desirable high specific surface should not be accomplished by reducing the "grindability" (lowering the surface tension) of the pulp by use of excessive frother. Rather it should be accomplished by mechanical means that create intense aëration.
6. Age of bubbles should be held to a minimum, perhaps by using relatively shallow cells.

LETTERS

(Continued from page 116)

Taking the quicksilver industry as an example for the period of 1920 to 1939, it was the exceptional mine which had more than one year's ore reserve in sight. During that period it was a common saying in the industry that none could see more than six months into the future. Thus the industry did not have an assured reserve of more than one year's production, and yet it existed and continued to produce for twenty years.

At the present time the quicksilver mines have reserves which under reasonably expected prices will run at three to six, and in some cases even eight, years in the future. The quicksilver industry is thus several times as healthy at the present time in so far as known ore reserves are concerned as it was before the war.

Probably we should not blame the current position of the quicksilver industry on Mr. Pehrson's article of February, but I at least believe in my own mind that Mr. Pehrson's statements have contributed to the current disaster that has overtaken the industry. Undoubtedly, Mr. Pehrson's figure of 97 percent exhaustion has been accepted by the War Production Board and other Government agencies as the final word on the quicksilver picture. With this in the background when the largest war requirements for mercury ever known occurred in the first six months of the year for production of mercury batteries for the Signal Corps, mercury was imported from Spain on a wholesale basis. Total consumption for 1944 was 43,000 flasks. Imports during the first seven months of this year alone were 47,000 flasks. When Army cancellations came through on V-J Day, over 20,000 flasks of mercury were made available to an unwilling market. Producers estimates that there must be close to 31,000 flasks of metal in the United States available, in addition to the government stockpile. A normal inventory is in the neighborhood of 10,000 flasks. As a result of this overimportation, it would appear that the mercury mines of the United States can now gracefully retire and wait for a year before anyone needs any newly produced quicksilver. At the present time metal is backing up in the hands of producers, and producers are laying off men and discontinuing furnace operations until there is some market for the metal.

Mr. Pehrson will probably use this decline in production as proof that American quicksilver producers cannot produce at the current nominal price of $100 a flask. This is not the case. Though the nominal price may be $100, there is no market for any appreciable amount at any price.

S. H. WILLISTON.
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